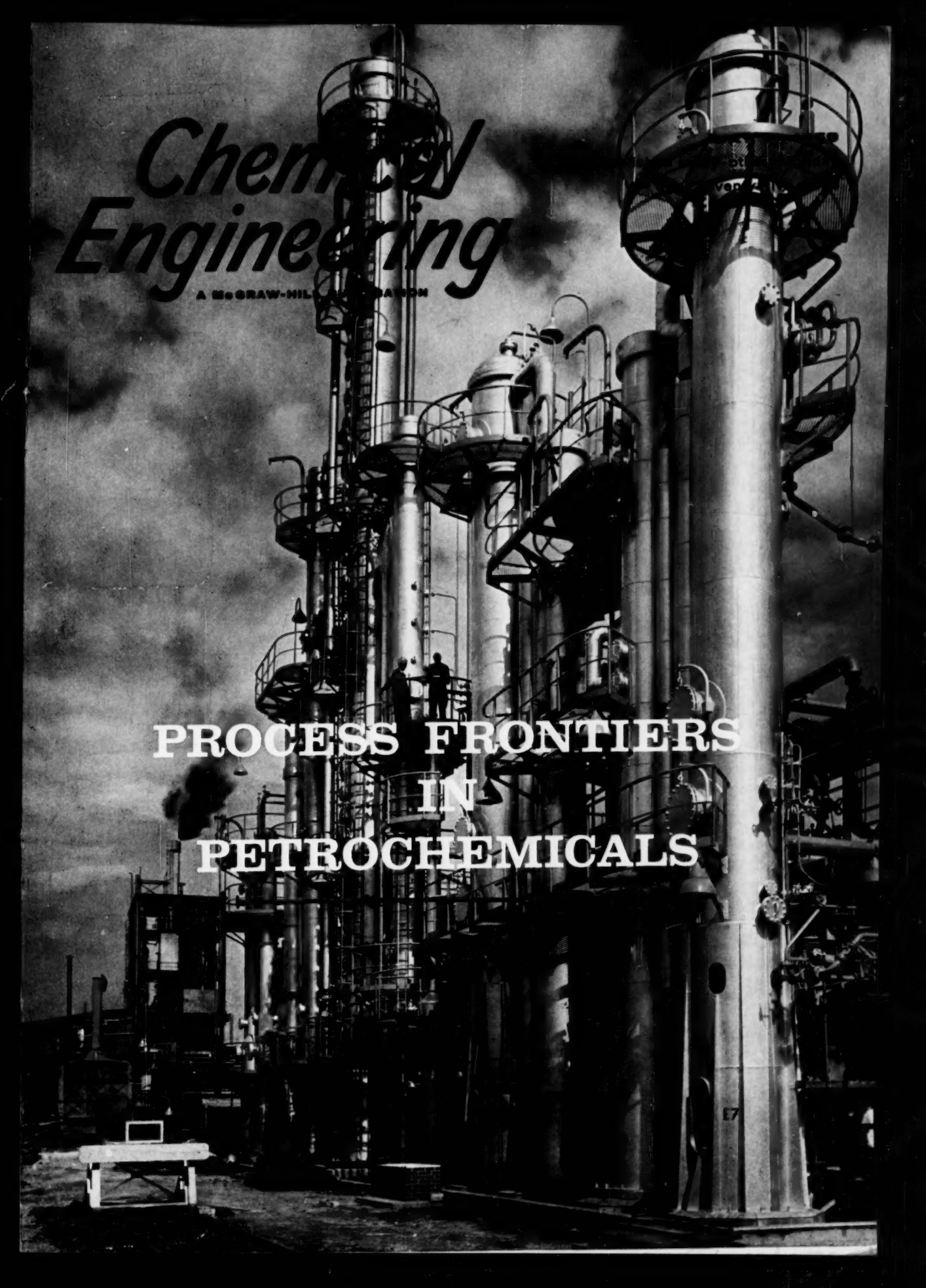
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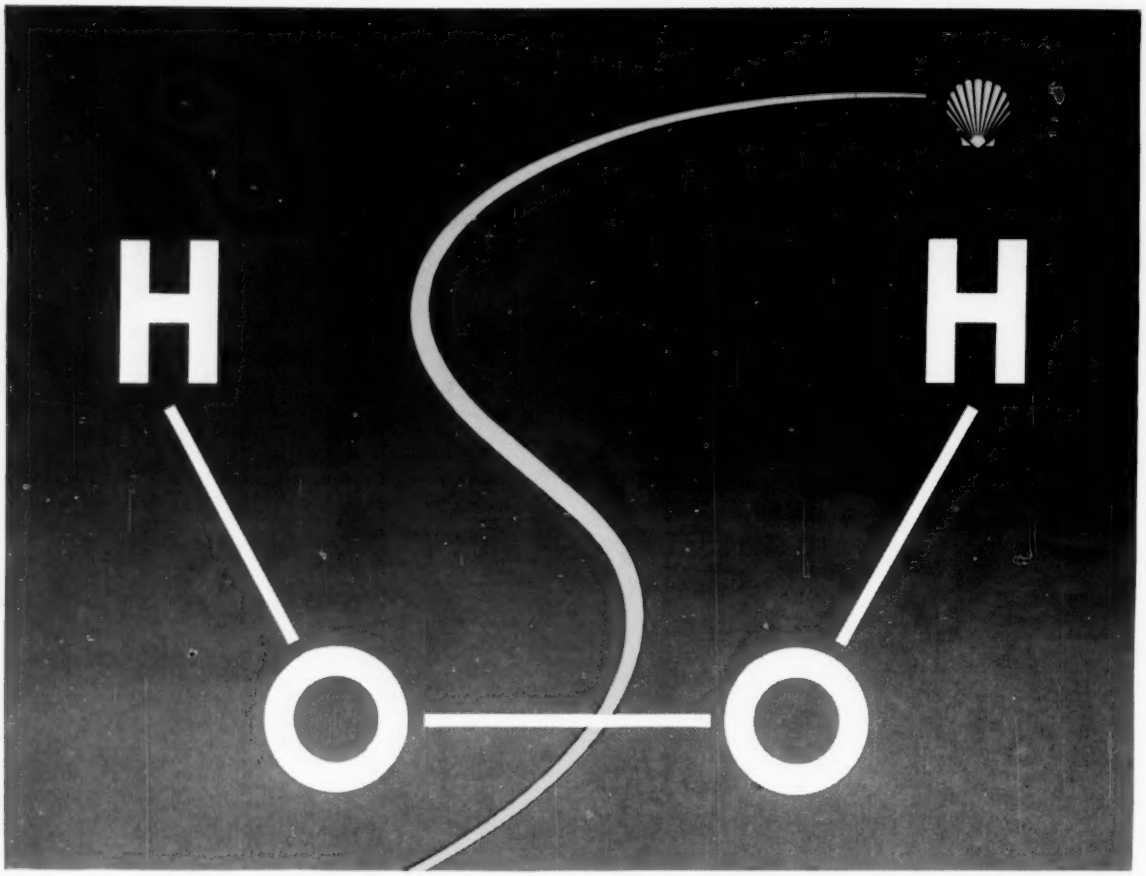
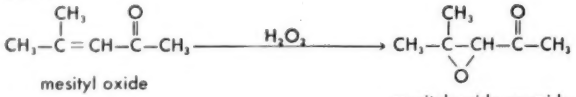


H_2O_2... practical source of oxygen for chemical synthesis

THE LIST of uses for hydrogen peroxide in chemical synthesis is growing steadily. If you manufacture plasticizers, resins, insecticides, or organic intermediates, you will find hydrogen peroxide a ready means for adding oxygen.

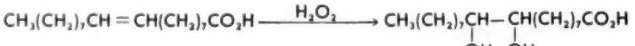
Hydrogen peroxide reacts under a variety of conditions and with a wide range of organic substances. Practical reactions include epoxidation, hydroxylation, peroxidation, and amine oxide formation. Examples are:

Epoxidation



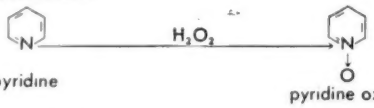
mesityl oxide — mesityl oxide epoxide

Hydroxylation



oleic acid — 9,10-dihydroxystearic acid

N-Oxide Formation



pyridine — pyridine oxide

Shell Chemical's laboratory facilities and field staff are at your disposal to help with problems in using, storing, and handling hydrogen peroxide. Phone or write for more information.

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improved performance in PROCESS EQUIPMENT

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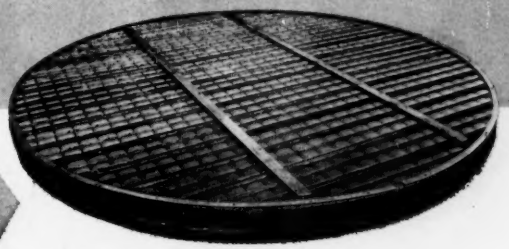
(ENTRAINMENT SEPARATORS·MIST-ELIMINATORS)



By proper entrainment control considerable savings in processes can be obtained.

YORKMESH DEMISTERS consist of a specially developed wire mesh manufactured by York. The geometry of the wire structure is carefully controlled to provide maximum performance consistent with maximum economy. No other separating media can match York performance.

by effecting complete liquid removal from any gas or vapor stream YORKMESH DEMISTERS make possible substantial savings in these typical applications:

by avoiding loss of product in:
EVAPORATORS, ABSORBERS, SCRUBBERS

by improving the quality of products and permitting higher thruput rates in:
VACUUM TOWERS, DISTILLATION EQUIPMENT, ABSORBERS, KNOCK-OUT DRUMS, STEAM DRUMS, GAS FILTERS

by reducing maintenance costs in:
COMPRESSOR SUCTION DRUMS, STEAM SEPARATORS, EVAPORATORS, REFRIGERATION SYSTEMS

by contributing to the solution of pollution control problems in:
SCRUBBERS, EVAPORATORS, ABSORBERS

Our bulletin #25 will be forwarded promptly on request.

Experience counts . . .

The experience gained in thousands of successful applications of Yorkmesh Demisters installed in all types of process equipment operating under widely varying conditions will be used in recommending to you the most suitable demister for your particular conditions.

If necessary a demister will be specially designed and constructed for your equipment; however, in practically all cases the desired performance will be obtained with one of the regular Yorkmesh styles listed here, with relative performance figures:

Yorkmesh Style No.	Residual Entrainment in parts per million
931	4.2
431	1.1
421	0.58
326	0.35

These results were obtained on an air-water system with 4" thickness of Yorkmesh. Increasing the thickness will further improve the separation performance.

Where complete details are furnished to us for our study and evaluation, our recommendations are unconditionally guaranteed to give the performance specified.

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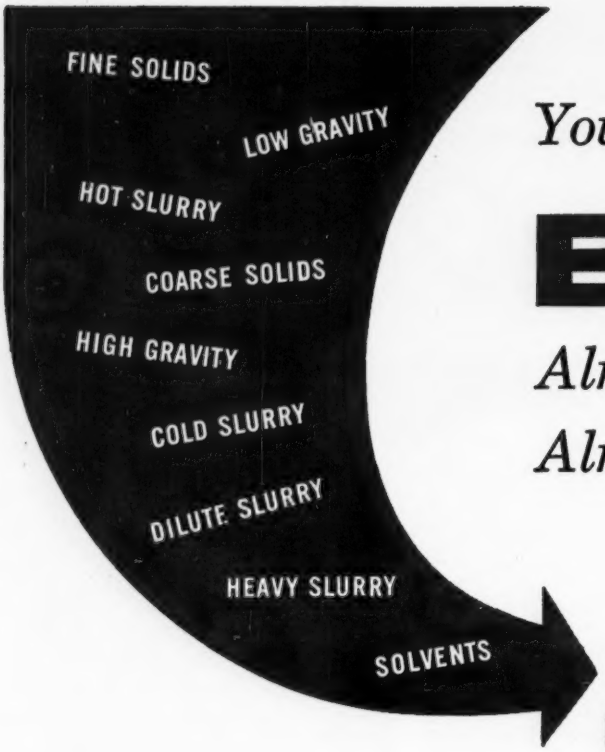

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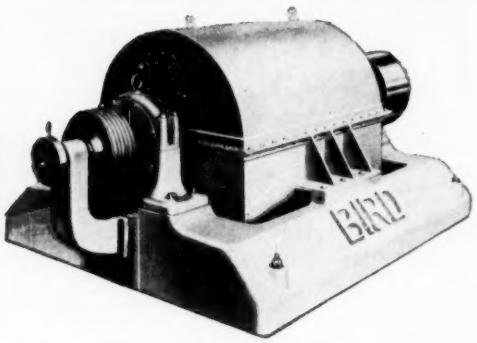

The BIRD CONTINUOUS SOLID BOWL CENTRIFUGAL

The BIRD CONTINUOUS SOLID BOWL CENTRIFUGAL comes in seven sizes. Each size is subject to twenty-five design variations depending on the job.

What's your particular need . . .
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Maximum liquid clarification?
Thorough wash?
Operation under pressure?
You name it. There is a Bird for your job.

With the BIRD, separating force can be gentle or as high as 3000 g.

Capacity can be as low as 0.25 cu. ft. or less per min., or as high as 60 cu. ft. or more per min. on coarse materials. Solids output can range from a few hundred pounds an hour to a ton or more a minute.

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What does this mean to you? It means that you never have to fit the separating job to the separating means. *The BIRD is designed and built to fit the job.*

To make certain that it *does*, the Bird Research and Development Center offers complete test facilities and an expert staff concentrating exclusively on solid-liquid separation problems. It is yours to use.

BIRD MACHINE'S 50th YEAR OF SERVICE TO INDUSTRY

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- Bird-Prayon Continuous, Rotary, Horizontal Vacuum Filters
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May 18, 1959 **Chemical Engineering** Vol. 66 No. 10

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CHEMENTATOR — Top Chemical Developments and What They Mean, 63
What's New and Significant in Research, 70

PROCESSES & TECHNOLOGY — New Cooler Levels Bed Temperature, 72
How Processor Converts Dust to Product, 74
Exposition to Portray Future Oil Technology, 78

CHEMICAL ECONOMICS — Go Abroad Chemical Processors, *Richard P. Windisch*, 82
Chemical Complex Moves Upstream, 88

NEW PROCESS EQUIPMENT — Flash-Curve Pilot Plant, 92
Equipment Cost Index, 234

NEW CHEMICAL PRODUCTS — Newsworthy Chemicals and Raw Materials, 98

PROCESS FLOW SHEET — Urea for Oil Dewaxing, 142

•

CHEMICAL ENGINEERING PRACTICE

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FEATURE REPORT — Chemicals From Petroleum, *Raymond F. Fremed*, 151

FEATURE ARTICLES — Fast Approach to Sizing Heat Exchangers, *John R. Cary*, 169
Control of Axial Compressors, *Robert E. Claude*, 175*
Begin Review of Unit Operations, *J. Coates, B. S. Pressburg*, 179

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Contents continued . . . turn page

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SHEET, WIRE AND TUBING

. . . Used Where Solid Platinum-group* Metal Properties are Desired but Cost Is Prohibitive

. . . And for the Added Engineering Properties of the Base Metal

Here's how one platinum-clad metal product

EXPANDED PLATINUM-CLAD TANTALUM ELECTRODES

— Can benefit you

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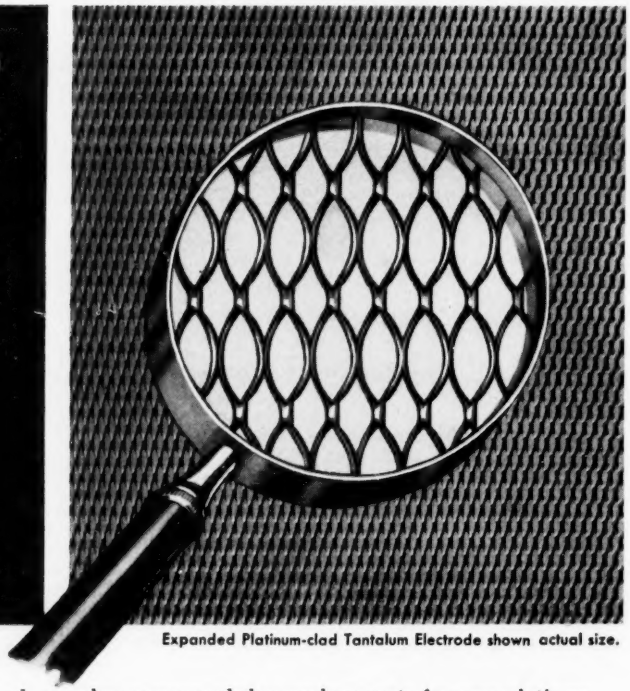
- Afford greater electrode distribution
- Offer service life equal to solid platinum
- Solve precious metal accountability problems



Expanded Platinum-clad Tantalum Electrode shown actual size.

Platinum clad to one side of tantalum sheet, and then expanded to a mesh can save you up to 80% in cost over solid platinum. General Plate's patented bonding process eliminates diffusion between the platinum and tantalum, a phenomenon which occurs in other methods of cladding.

Initial application of this material is for rhodium electroplating anodes. The greater distribution of anode surface obtained by the expanded clad metal allows more uniform plating. In electro-chemical processes, such as rhodium plating, the tantalum layer is not affected by chemicals in the plating bath . . . nor does it contaminate the bath. Generally, where solid sheet platinum electrodes are used, the "back" surface is almost inoperative. For this reason, even though the tantalum surface becomes passive after a few minutes of use, double cladding is not necessary.

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General Plate also has modern assaying and refining facilities which include complete equipment for the recovery of platinum and platinum-group metals from crude ore, spent catalysts, and scrap material.

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PRINT ORDER OF THIS ISSUE 49,623

PROCESS DESIGN NOTEBOOK

Revamp Successful on Old Evaporator, *Chesman A. Lee*, 184
Easy Check for Process Flows, *C. F. A. Roberts*, 186
"Walk" Your Pipe up Without a Hoist, *W. G. Hudson*, 188
Isolating Seal for Gages, *Herbert P. Cantelow*, 188

YOU & YOUR JOB

Your Rights Under Collective Bargaining, *Robley D. Stevens*, 190

CORROSION FORUM

Prestressed Brick: Cure for Lining Woes, *John A. King*, 194
New Alloy More Resistant Than Pure Titanium, 200

•

OTHER REGULAR FEATURES

Firms in the News, 203
Convention Calendar, 216
More New Equipment Developments, 220
Technical Bookshelf, 236
Letters: Pro & Con, 238
Classified Section, 269
Equipment Searchlight, 270

•

READER SERVICE

Reader Service Postcard, 245
Reprints Now Available, 247
Guide to Technical Literature, 248
Advertisers in This Issue, 276

•

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"The tremendous growth of the processing industry has brought with it some corresponding problems. There is the constant need for higher efficiencies, greater capacities, higher speeds and closer controls.

"Here at De Laval, we have a three part program to help processors overcome these problems: an outstanding engineering staff, the most complete pilot plant in the country, and a full line of proven process equipment.

"In some cases, it simply means replacing more traditional methods with up-to-date equipment. One of our customers replaced a batch settler 26′ deep with a diameter of 16′ with two new high capacity centrifuges. Manpower requirements were cut in half; the yields and quality were far higher; and total processing time was considerably reduced. Perhaps most important, the new method is *continuous*.

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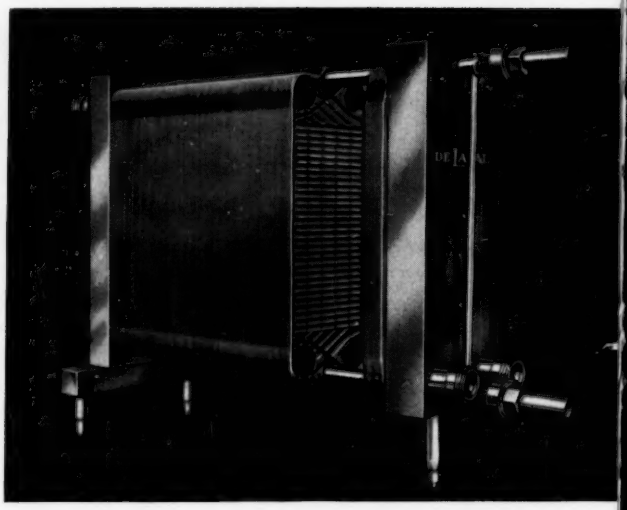

THREE SOLVED WITH

Little centrifuge does a big job for processor of ball-point inks

Problem: To remove all oversized particles and agglomerates in ball-point inks. Otherwise, the ink would plug in ball-point pens.

Solution: The De Laval Gyro-Tester. Only slightly more than 18" high, this unit thoroughly clarifies up to 25 gallons of ball-point ink per hour.

A big advantage in this installation, the small bowl size minimizes bowl cleaning time between runs of different colored inks.

Although the unit is small (approximately 10" wide by 15" long by 18" high), it develops centrifugal force of 10,000 g's. That's enough to clarify the inks of particles down to one micron in size.

De Laval Gyro-Testers are used more commonly for pilot scale work in processing plants to determine the nature of full scale processing operations. The units cost well under $1000.00, and have more than proved their worth in all phases of the processing industry.

If your processing operations could benefit from pilot work on your own site or from sample runs on new materials, why not write for more descriptive information about the De Laval Gyro-Tester? There's no obligation, of course.

Antibiotic processor saves six million BTU's in every hour of operation

Problem: How to heat 60,000 lbs. per hour of antibiotic broth from 72°F. to 170°F. under completely sanitary conditions and make the most efficient use of the heating medium.

Solution: The De Laval Plate Heat Exchanger. Constructed entirely of Type 316 stainless steel, the unit maintains the sanitary condition essential to this product. The Plate Heat Exchanger is cleaned after each run by flushing *in place*. When manual cleaning is necessitated, the plate pack is easily opened for complete exposure of all heat transfer surfaces.

No other type of heating or heat transfer unit can touch the efficiency of the De Laval Plate Heat Exchanger. This processor alone saves better than six million BTU's for every hour the unit is in operation.

Besides the tremendous problems inherent in cleaning a Shell & Tube Exchanger, a competitive quotation in this same installation indicated it would cost nearly twice as much. If it had been chosen, the processor would have had to erect the exchanger outside of his building and at considerably higher installation expense. The Plate Heat Exchanger is a compact piece of equipment. It can be installed inside your plant, and takes a minimum of floor space.

Whatever your heating or cooling requirements, you'll probably find that there is a plate heat exchanger readily available to meet your specific needs. Temperatures can be controlled to within 1°F. and held exactly for hours on end. If you'd like more information, just drop us a line about your process on your letterhead. No obligation, of course.

PROCESSING PROBLEMS... DE LAVAL PROCESS EQUIPMENT

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Classifying crushed ore into four grades with efficiencies over 95%

Problem: How to classify production quantities of crushed perlite ore into four grades with closely held tolerances and maximum efficiencies.

Solution: The De Laval Syncro-Matic Separator. This is a new type of vibrating screen, with motion controlled in *three* directions. Horizontal, vertical and gyratory motion are *all* individually controlled, and give the Syncro-Matic what we call TDM (three dimensional motion).

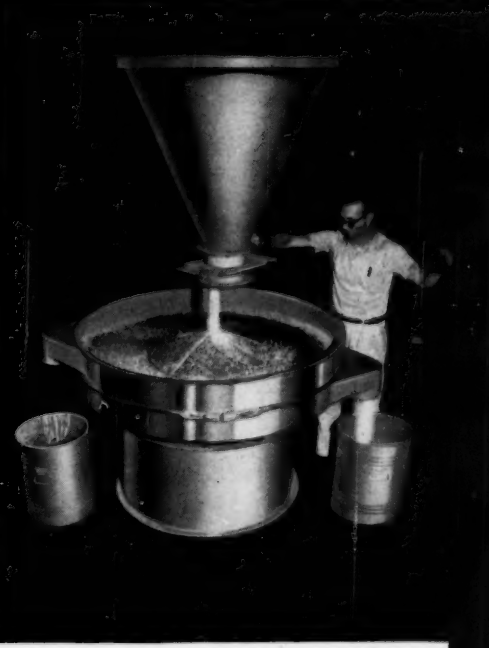
This means a tremendous increase in throughput as well as vastly increased efficiencies of separation. In the case of the processor separating crushed perlite ore, it enabled him to achieve better than 95% efficiencies in all four grades of separation with a throughput of better than five tons per hour.

The calibrated controls of the Syncro-Matic indicate adjustment ranges for frequency and each element of motion. Once optimum settings have been determined, they may be noted and reset for immediate top efficiency whenever the same type of product is to be processed in the plant.

The action is not affected by a varying feed rate; efficiency is constant whether the machine is set for gentle or turbulent action.

The Syncro-Matic is available in carbon or stainless steel, with from one to three decks, and a full range of screen meshes and materials. Operation is exceptionally quiet.

If you would like more information about this versatile new screen separator, just drop us a line on your letterhead. There is no obligation of course.



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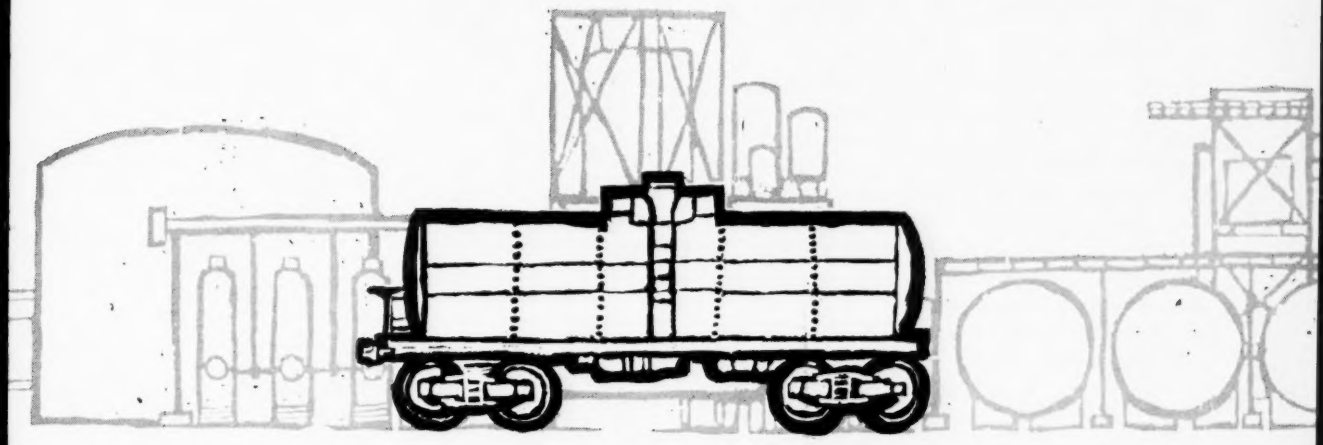
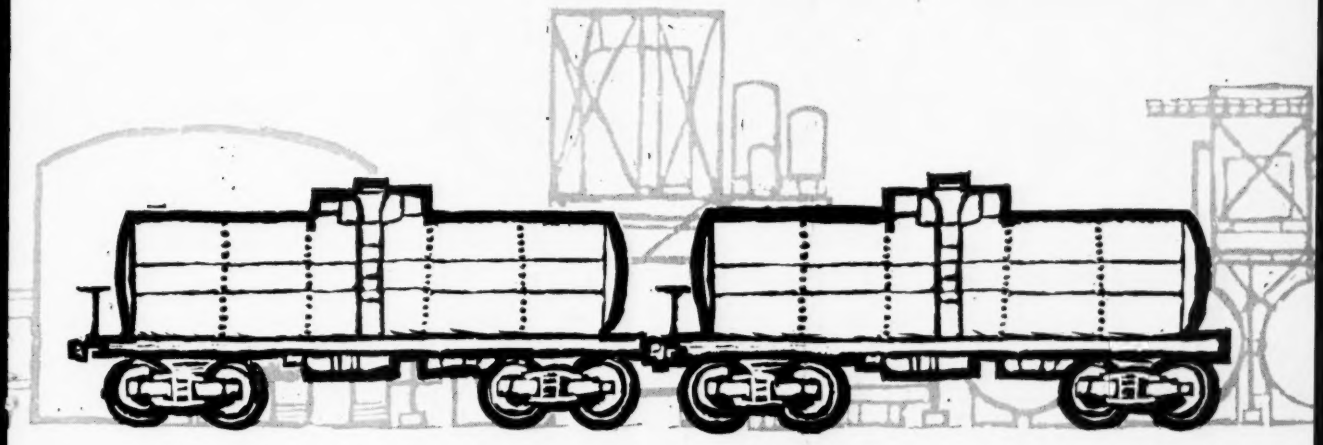


Olin Mathieson did and doubled production



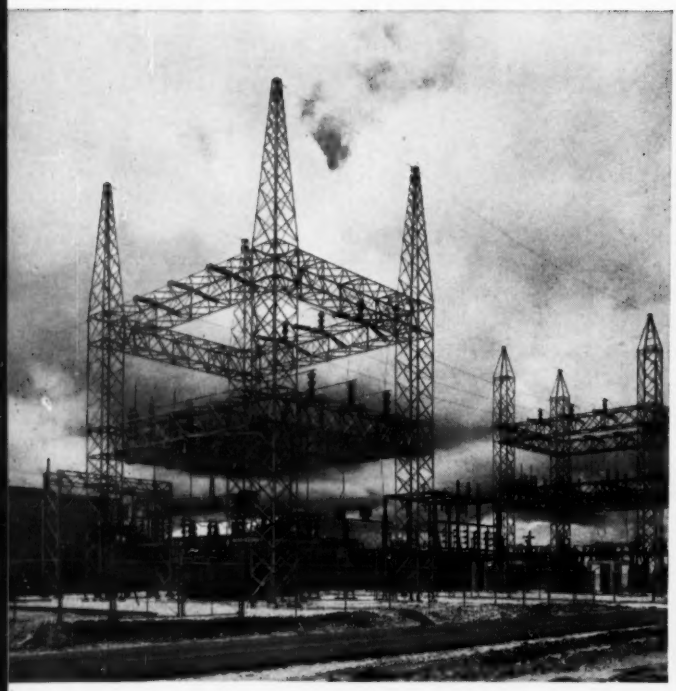
Olin Mathieson doubled production and reduced overhead at their Chlor-Alkali Plant in McIntosh, Alabama. Engineered and constructed by the Blaw-Knox Company, capacity was doubled at a cost of only two-thirds the initial investment.

If you want more capacity to meet the doubled production required by 1965, your Westinghouse representative can help you with a practical solution.

YOU CAN BE **SURE**...IF IT'S **Westinghouse**

here's how Olin Mathieson

Olin Mathieson Chemical Corporation's Chlor-Alkali Plant built by Blaw-Knox Company at McIntosh, Ala.



Twin modern substations equipped with Westinghouse metal-clad switchgear provide superior circuit protection. Fast and positive arc interruption is assured.

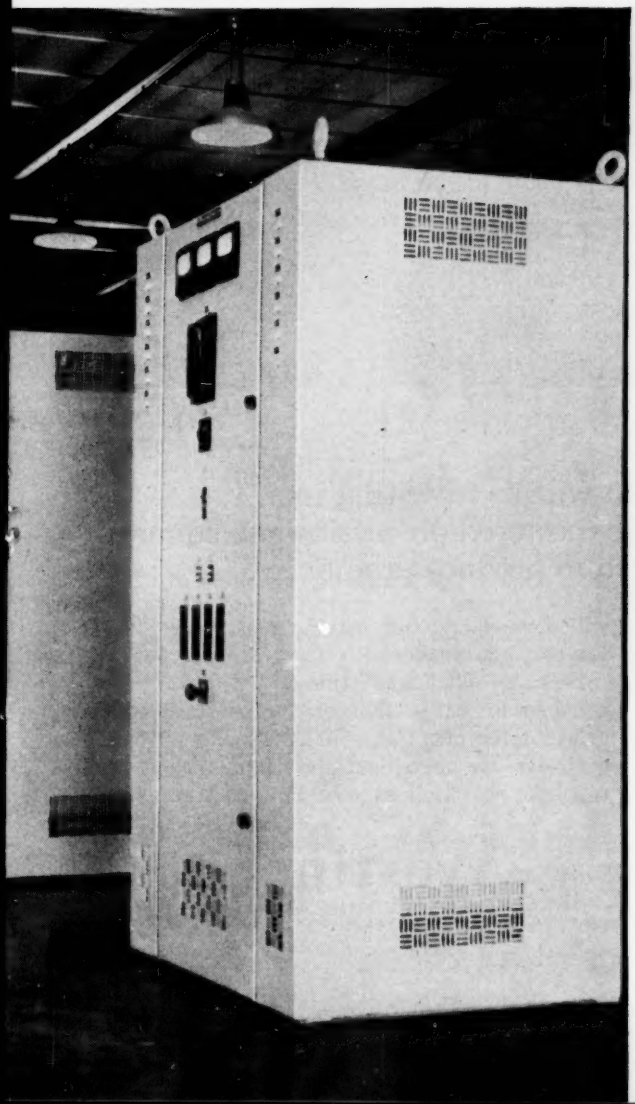
High mechanical and dielectric strength are two of many plus benefits of the design used in these Westinghouse transformers.

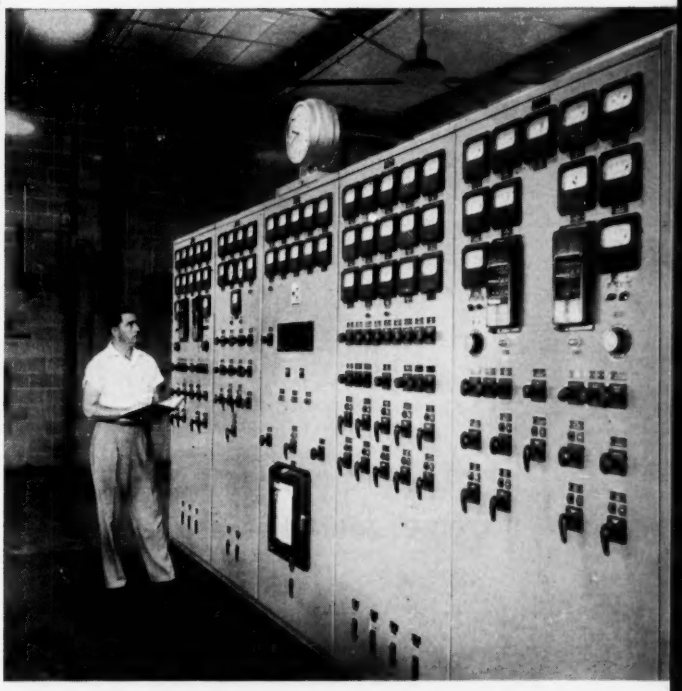
These Westinghouse rectifier auxiliary control cubicles provide smooth, fast variation in output voltage for the exacting demands of electrochemical processing. Here, under constant full capacity load, Westinghouse rectifiers have proved their ability to perform efficiently and with a minimum of maintenance.

POWERED-UP with Westinghouse

Blaw-Knox, the general contractor, had future expansion in mind when planning started on Olin Mathieson's Chlor-Alkali Plant to be built in McIntosh, Alabama. They determined the electric energy requirements. Then, Westinghouse engineers worked out the most efficient and economical equipment and control to meet these specifications. Westinghouse, Blaw-Knox and Olin Mathieson, working together, decided on certain oversized equipment in anticipation of future needs. This planning paid off. In 1957, capacity was doubled at a cost of $8,000,000 as compared to the initial investment of $12,000,000.

The present daily consumption of electrical energy at this plant is 1,000,000 kilowatthours—equal to the power requirements of a city with a population of 300,000.





This custom designed duplex switchboard installation controls and supervises the electrical circuits. Walk-in cubicle construction makes maintenance easy with equipment protected yet readily accessible. Uniform appearance of all instrument and relay Flexitest* cases gives unit clean, modern appearance.

*Trade-Mark

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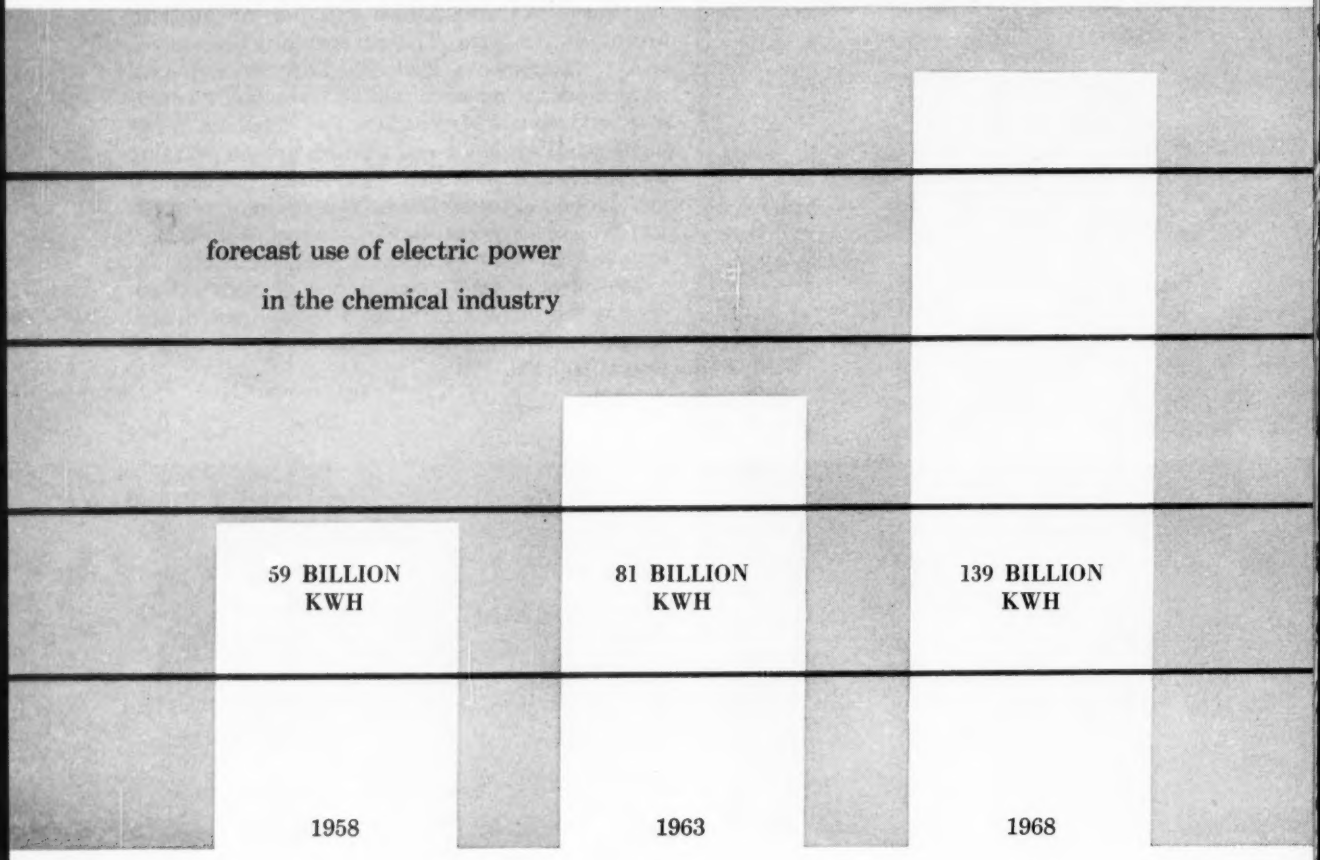
here's why you should plan now to
POWER-UP FOR PROFIT ELECTRICALLY



To stay competitive, you will be investing in a tremendous increase in electrically powered processing machinery. Be sure it is engineered to produce profits.

Power-Up is a Westinghouse program to help you increase profits through greater productivity. In your plant it may be a materials handling system, higher capacity machinery, or a more productive environment through higher lighting levels and air conditioning. One thing is certain—whether or not you earn satisfactory profits in the '60s will depend on your making maximum use of low-cost kilowatthours.

Be sure—like Olin Mathieson—that your electrical equipment is engineered to produce profits as well as output. Call your Westinghouse representative. He can tell you the electrical steps you can take *now* to start your Power-Up program.

J-96109

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Where skillful hands work for you

Craftsmanship follows through on every stage of the design and fabrication of pressure vessels and heat exchangers at Downingtown Iron Works. Come and see for yourself. Inspect our shop procedures on work in normal progress. Or write for helpful Bulletins HE and CI.

A **On the nose**—Accurate fit-up...a second check after tack welding...another before shipment...assure nozzles are on the nose, save installation headaches.

B **Detailing your ideas**—in language the shop man understands—means that equipment fabricated here carries out your plans, meets your process requirements.

C **"X" marks the spot**—and punch mark guides true center of tube hole...holds close ligament tolerances... assures accurate tube sheets and efficient operation.

D **A Downingtown extra**—Back-chipping nozzle weld assures sound weld metal through and through...is one of the DIW extras that go beyond code requirements.

Downingtown Iron Works, Inc.

140 Wallace Ave., Downingtown, Pennsylvania

division of **PRESSED STEEL TANK COMPANY** Milwaukee

Branch offices in principal cities

HEAT EXCHANGERS—STEEL AND ALLOY PLATE FABRICATION
CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

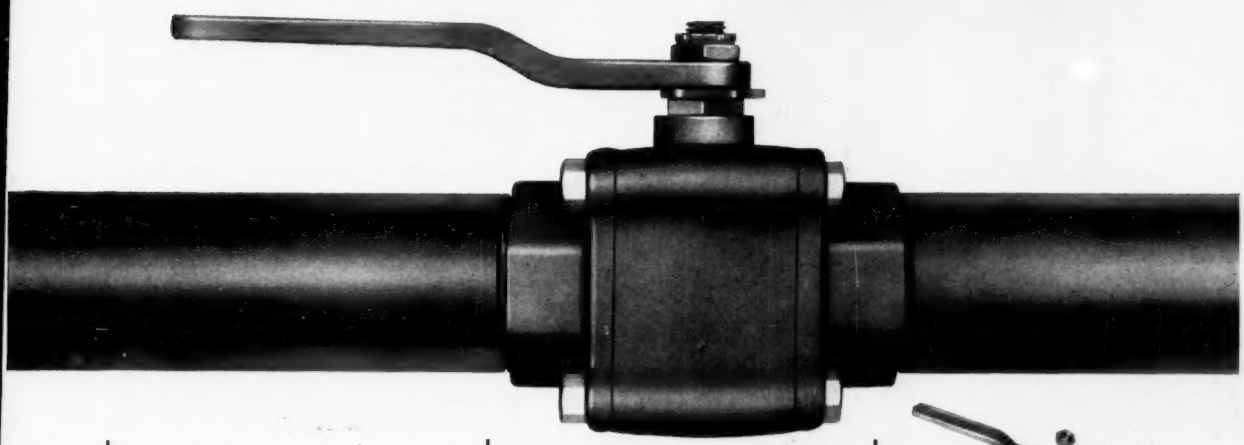
COMPARE . . .

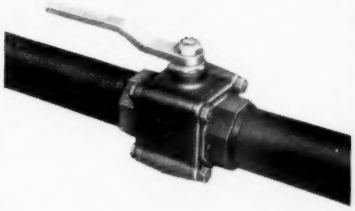
	ECON-O-MISER	GATE VALVE	FLANGED GATE VALVE	DIAPHRAGM VALVE	LUBRICATED PLUG VALVE
FLOW CHARACTERISTICS	Smooth round flow	Turbulence results in excessive pressure drop	Turbulence results in excessive pressure drop	Turbulence results in unusually high pressure drop	Constricted flow . . . pressure drop
METHOD OF CONTROL	CLOSED ¼ turn operation OPEN	2½ to 3½ turns of hand wheel	2½ to 7 turns of hand wheel	2½ to 3½ turns of hand wheel	¼ turn operation
MAINTENANCE CHARACTERISTICS	Seats and "O" Rings easily replaced	Valve normally thrown away	30% to 50% of purchase price	In-line maintenance possible	Regular lubrication necessary to maintain seal
SIZE 2" TO 12"	CENTER TO TOP—OPEN 3 5/16"	12 5/8"	16 1/2"	7 1/4"	10 1/2"
LIFE EXPECTANCY	Half million cycles not unusual	Metal-to-metal seating limits life	Metal-to-metal seating limits life	Better than gate valve	Very good if lubricated regularly

THE ECON-O-MISER BALL VALVE IS THE IDEAL REPLACEMENT FOR MO ON-OFF VALVES NOW IN USE IN TH PROCESS INDUSTRIES!

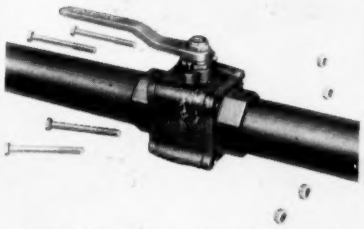
MORE EFFICIENT . . . LESS COSTLY

THE ECON-O-MISER BALL VALVE





Compact, efficient ECON-O-MISER Ball Valves are today's smoothest operating on-off valves. A quarter turn of the handle allows full operation and you can tell at a glance whether the valve is open or closed. More . . . ECON-O-MISER Ball Valves act as both valve and union . . . eliminate costly inventory and labor. Minimum turbulence and greater economy make this valve ideal for hundreds of applications.



Remove four nuts . . . four bolts . . . and the entire center section lifts out for servicing. Quick, convenient maintenance saves money **and** this unique design means pipe ends never have to be removed from the line. Seating surfaces and O-Rings are easily replaced . . . whole valve back in operation in minutes. Reduces inventory expenses and frees maintenance personnel from time consuming repairs.

The ECON-O-MISER Ball Valve is available in many combinations of seats, O-Rings and body materials. Almost any media can be handled by the ECON-O-MISER and sizes range from ¼" through 6". Made of bronze, aluminum, carbon steel, stainless steel or aluminum bronze. We'll be happy to furnish information or application data.

THE ONLY VALVE IN INDUSTRY THAT SERVES AS BOTH VALVE AND UNION!

Complete, technical information in new "Comparison" bulletin.

Request EB 101 on your letterhead or fill in coupon.

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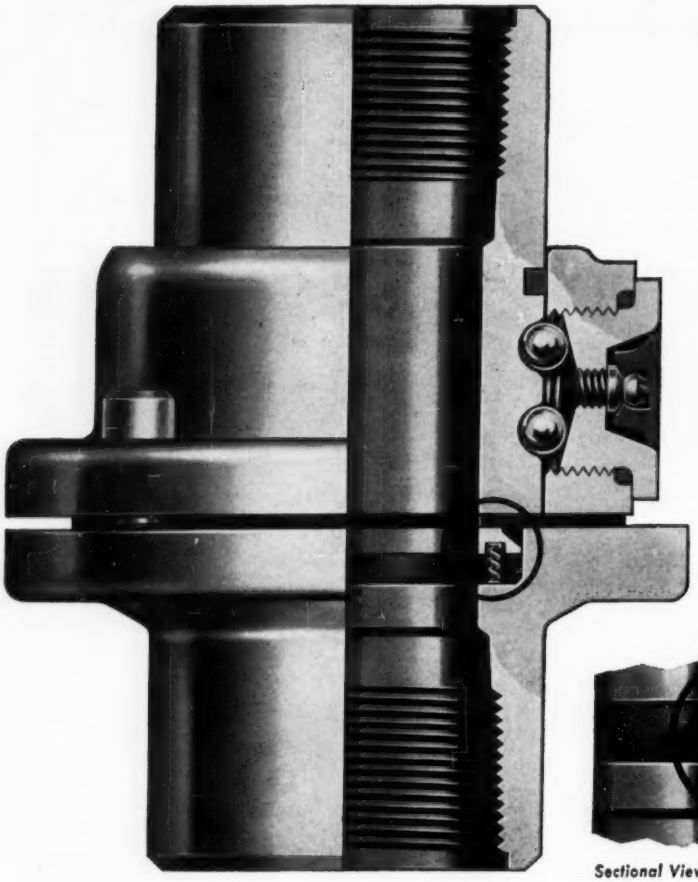
☐ Please forward bulletin EB 101. ☐ Please ask sales engineer to call for appointment. ☐ Send information on ECON-O-MISER FLANGE BALL VALVE.

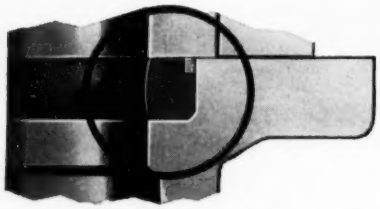
WORCESTER VALVE CO., INC.

DEPT. A • 16 PARKER STREET • WORCESTER, MASS.

For Trouble-Free Flexibility on Steam, Hot Gas, Chemical Service Lines



For the engineer concerned with flex or rotational problems, on lines handling steam, hot gas or chemicals, the new DS swivel joints present a quick, effective solution. Versatile packing design permits use of either disc or molded types of packing to meet a wide number of services. Split segments allow replacement of packings within minutes and without removing joint from the line. And within the eight basic configurations of the new DS series joint are models to provide full 360° rotation in one, two or three planes. DS series swivel joints are recommended for chemical services ranging from −40° to +400°F and 300 psi. In steam rotation, the maximum is 440°F at 360 psi. For complete details on this remarkable series of Chiksan swivel joints, write today for your copy of Bulletin 1258.

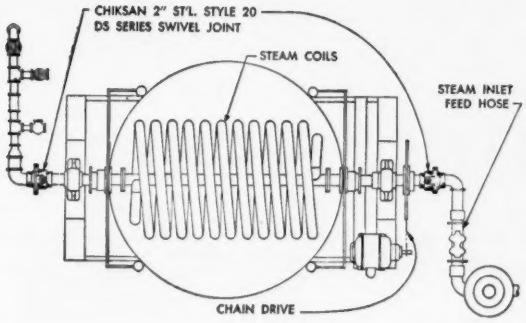


Sectional View showing typical molded packing installed

NEW *CHIKSAN* DS

REPLACE SEALS WITH SWIVEL JOINT IN LINE

Allen-type screws secure the two sections of the DS series swivel joint. Screws are readily removed and seals replaced with joint in the line.

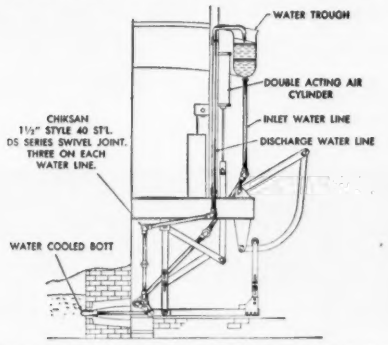


ROTATING STEAM COIL IMPROVES COOKING QUALITY, CUTS COSTS

For more details, request application report .009

Stationary steam coils in a large food processing plant were accumulating burned scale, reducing heat transfer by as much as 20% in a relatively short time.

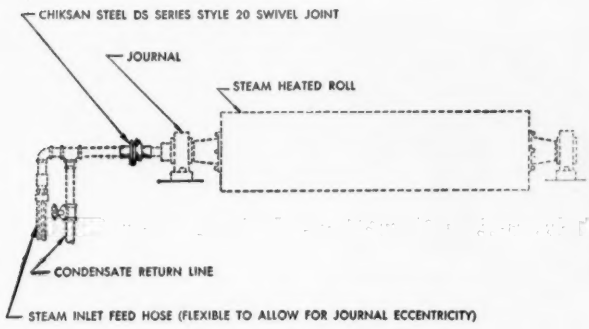
Using Chiksan DS series swivel joints, the plant engineer designed a self-scouring rotating coil. Net results, this plant now gets closer flavor and quality control—also sustains heat-exchange efficiency—thus saving fuel.



SWIVEL JOINTS HELP PULL THE PLUG ON MOLTEN SLAG

For more details, request application report .014

Pulling the water cooled bott permits removal of molten slag from blast furnaces. Proximity to the intense heat made rubber hoses out of the question. And even ordinary swivel joints weren't faring too well because packings would bake out in a day or two. New Chiksan DS series swivel joints deliver the solution, providing ten to twelve weeks of service before packing replacement is required.


CHIKSAN STEEL DS SERIES STYLE 20 SWIVEL JOINT
JOURNAL
STEAM HEATED ROLL
CONDENSATE RETURN LINE
STEAM INLET FEED HOSE (FLEXIBLE TO ALLOW FOR JOURNAL ECCENTRICITY)

STEAM STAYS ON THE BEAM WITH CHIKSAN SWIVEL JOINTS

For more details, request application report .004

To emboss plastic sheets, the material must be heated to a just-right degree of softness. A steam leak at the swivel joint connecting the stationary steam pipe to the revolving inlet means serious trouble. Previous tried devices were unsatisfactory. A DS series swivel joint was recommended. Present joint has been in service for better than four months with superior results. And when packing fatigue does occur, it can be quickly replaced with a minimum down time.

SWIVEL JOINTS

SERIES

CHIKSAN COMPANY, 330 North Pomona Avenue, Brea, California
Please send me copy of Bulletin 1258.
Please send me product application report .004 ☐ .009 ☐ .014 ☐

Name_____

Company_____ Title_____

Address_____

City_____ Zone_____ State_____

CHIKSAN fmc

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

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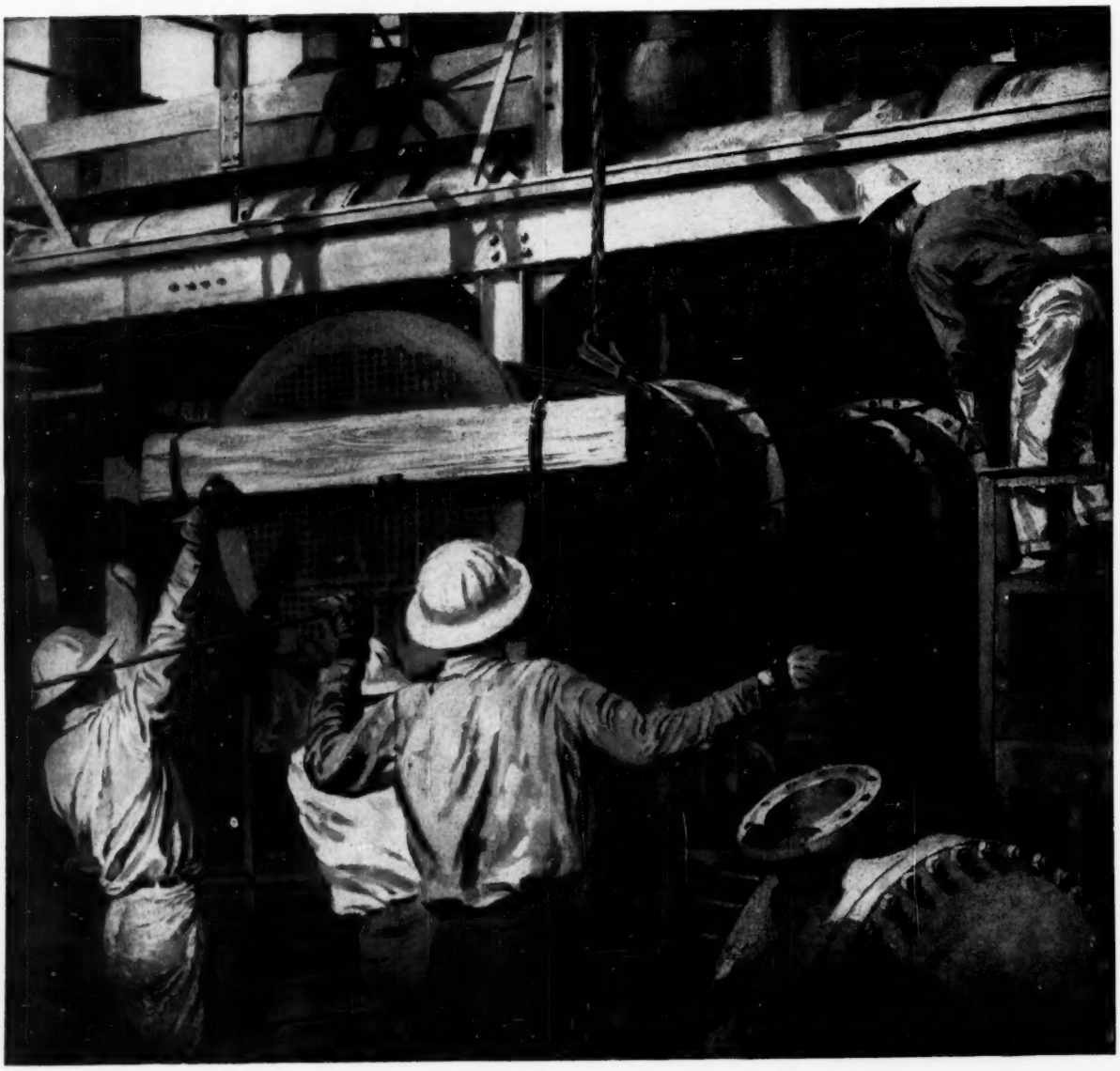
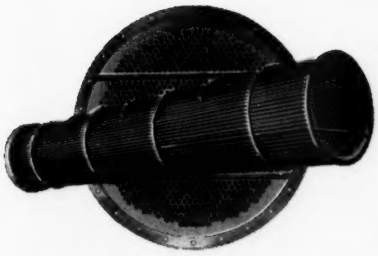
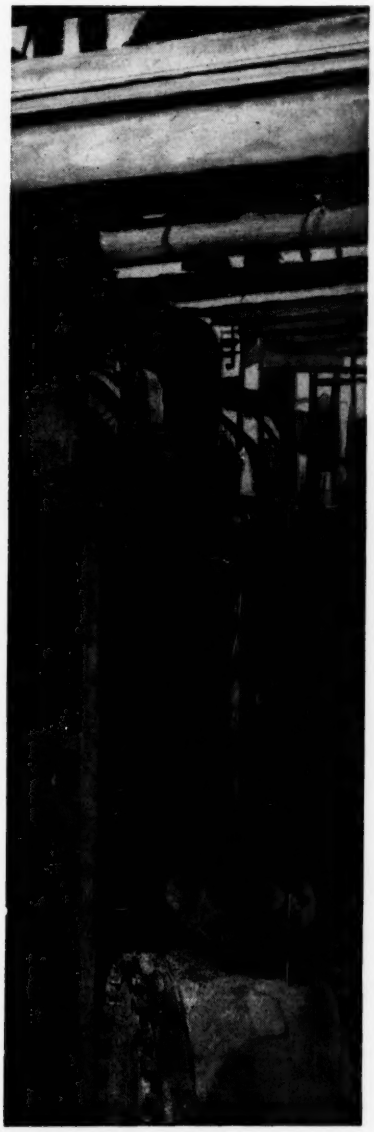
HEAT EXCHANGER AND CONDENSER TUBES

FOR LONG-RUN RELIABILITY!







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- Experienced engineering staff at your service to help solve tube corrosion problems.

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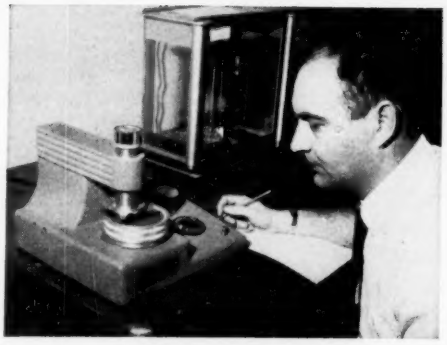
FIRST FOR LASTING QUALITY—FROM MINE TO MARKET!

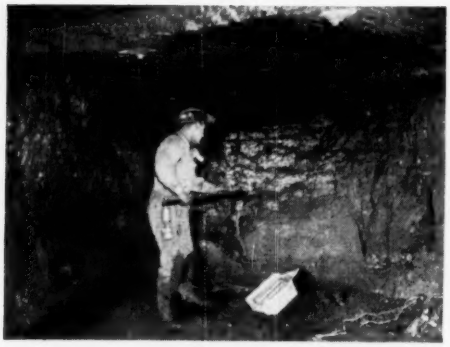
CYANAMID

Chemical Newsfront

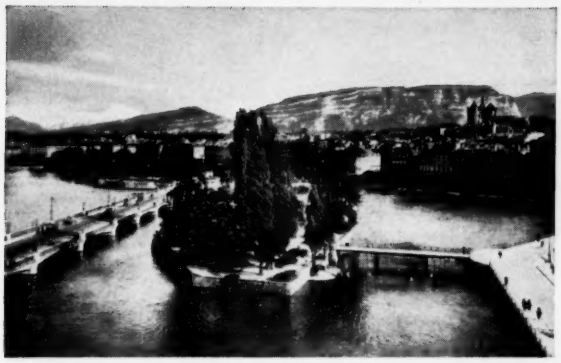
MISSILE SEES RED—INFRARED. A relatively simple, yet unique, system guides the fantastic Philco SIDEWINDER air-to-air missile into target on the hot exhaust of enemy jet aircraft. Infrared radiations of the target attract the missile which can actually zoom into the tailpipe of a jet. Much of the printed circuitry in the SIDEWINDER incorporates FORMICA® *laminated plastics*, which must be compact and light and yet provide insulation against tremendous heat generated by rocket motors. **(Formica Corporation)**



WEAR-TESTING is an essential and continuing process with Cyanamid's new CRESLAN® *acrylic fiber*. Laboratory physical tests are evaluated with thousands of hours of actual wear-testing in this fabric and market development program. Above, a lightweight suiting fabric of CRESLAN acrylic fiber and wool is subjected to a punishing appearance-retention test. Hundreds of thousands of hours of such tests have already been evaluated, making CRESLAN one of the most thoroughly tested new fibers in history. **(Fibers Division)**



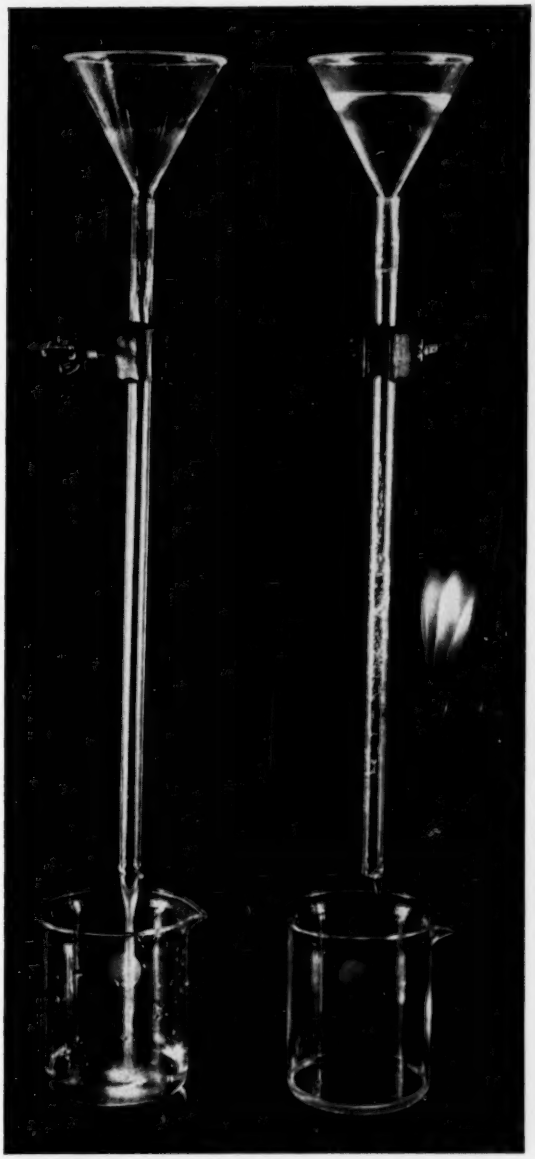
INCREASED PRODUCTION OF COAL, vital for fuel, steel and chemicals, is possible using Cyanamid's AMERICAN® and BLACK DIAMOND® permissible explosives. Mining safety, too, is improved by the use of these time-tested products and Cyanamid's reliable electric blasting caps. These products along with Cyanamid's mining chemicals for the coal industry were on exhibit at the annual Coal Show of the American Mining Congress in Cleveland, May 11-14. **(Organic Chemicals Division)**



CYANAMID PICKS GENEVA, SWITZERLAND, as the site for the new Cyanamid European Research Institute, Inc. The new scientific center will be devoted to long-range basic research in the chemical and biological sciences. It will be staffed entirely with European scientists, whose work will be directed toward uncovering new basic scientific information. It is expected to provide an invaluable supplement to the diversified program of basic and applied research in which Cyanamid today is investing $25 million a year.

TODAY'S GIANT PETROLEUM INDUSTRY dates right back to this scene 100 years ago: Col. Drake, drilling in Titusville, Pa., brought in the world's first oil well. First exploited principally to provide light, petroleum grew in importance with the increasing acceptance of the automobile and now refineries and wells cover the entire world. Cyanamid, an international supplier of petroleum catalysts, as well as many other products, has kept pace with the industry, serving its needs as it changed from a brawling, lusty art to a highly technical automated industry.

(Industrial Chemicals Division)



NOW SOLIDIFY WATER BY HEATING. Unique CYANOGUM® 41 forms non-viscous solutions in water that will gel at elevated temperatures. Above left, CYANOGUM solution flows freely at room temperature but gels in heated tube on right. Dissolved electrolytes and undissolved solids, such as sand, clay charcoal and even sulfuric acid, do not affect the gel which retains its characteristics over a wide range of temperature variations. If solid water or a heat-induced gel will help your product or processing, write for full technical information.

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CYANAMID

AMERICAN CYANAMID COMPANY

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

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Chemical Newsfront

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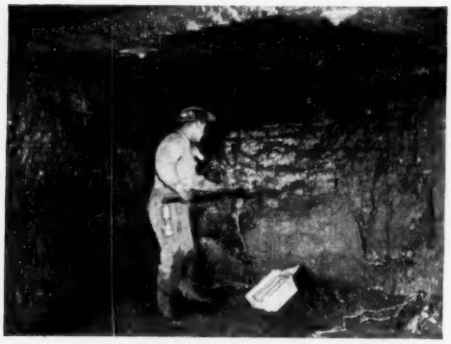

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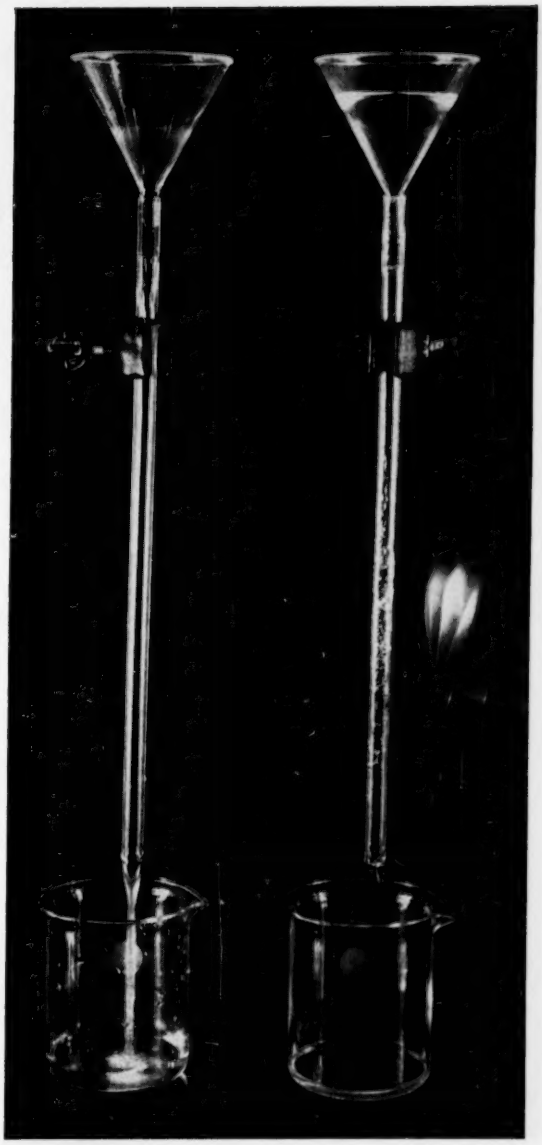

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For further information on these and other chemicals, call, write or wire American Cyanamid Company

Charles G. Cooper, *Vice President,*
The Cooper-Bessemer Corporation, explains...

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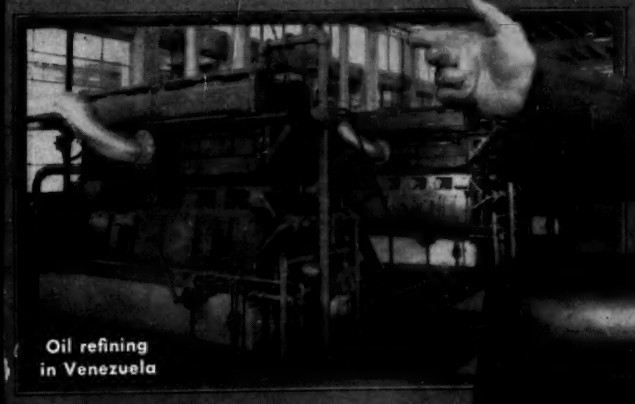
Processing fertilizer in India

Compressing gas in Near East

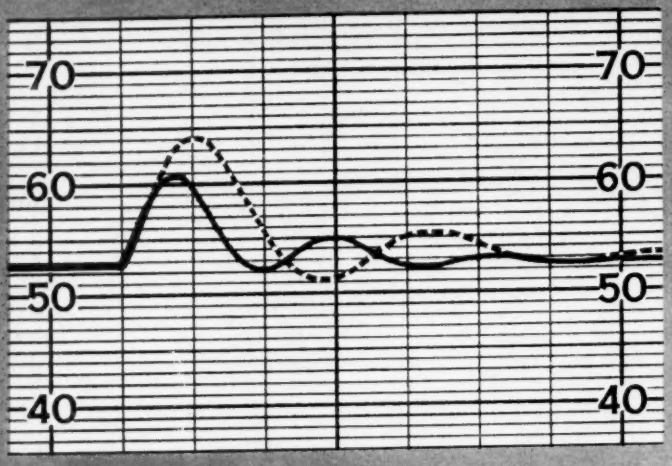


Oil refining
in Venezuela

86% DIFFERENCE IN CONTROL

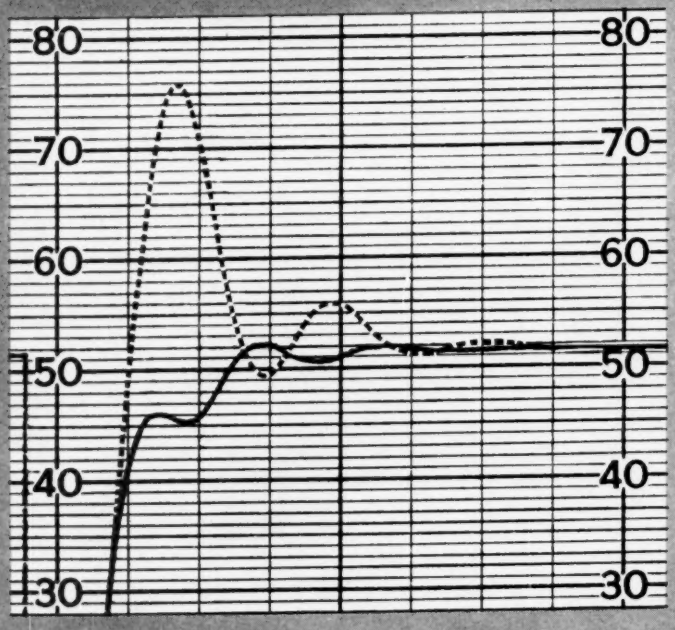
On process load change

The actual area between the recovery curve of the conventional 3-response controller (dotted line) and the set point is 86% greater than that of the Tri-Scope Controller (solid line). Quality of Tri-Scope control is that much better.



On start-up

Here is the perfect solution to your problems of overpeaking on start-up and large load changes—inherent weaknesses of proportional-plus-reset controllers. It is equally effective *at all times* whether variable is approaching control point from above or below—on start-ups, or following major process disturbances or changes in set point.



Taylor Instruments

ONLY 8% PREMIUM IN PRICE!

Taylor TRI-SCOPE* Controller performance records give overwhelming proof of its outstanding superiority

The charts at left show how the full-time use of derivative-ahead-of-reset response in the TRI-SCOPE Controller (solid line) compares with results achieved by a conventional 3-response controller (dotted line).

Quality of control is a function of the *size* of the deviation and the *time* required to regain the control point. Thus, the area under the recovery curve is a measure of quality. Since, with a conventional 3-response controller the area above the control point is 86% greater, then the TRI-SCOPE quality of control is that much better.

The additional cost for these vastly superior control qualities amounts to only 8%, when you consider the price of transmitter, recorder, valve and conventional controller, versus these same instruments and the TRI-SCOPE Controller.

It is a matter of simple economics. If your product is important enough to justify investment in a 3-response controller, 8% is a very small premium to pay for 86% difference in control. *Figure your savings over the life of the instrument!*

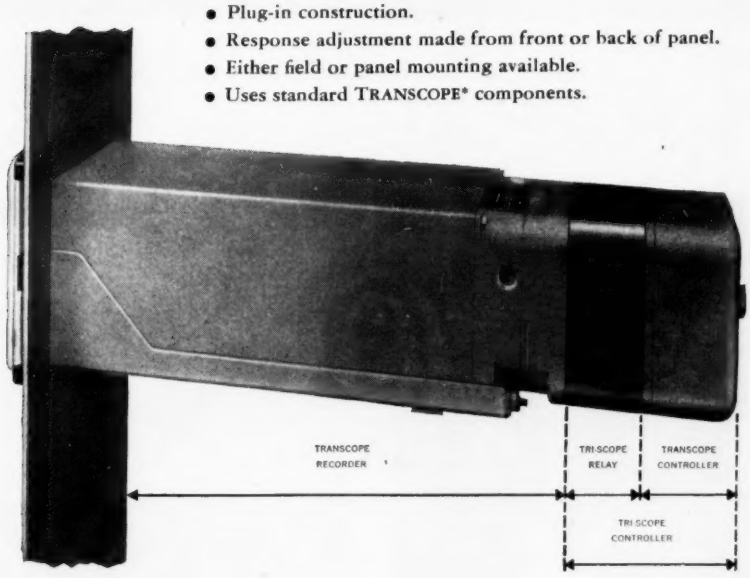
• • •

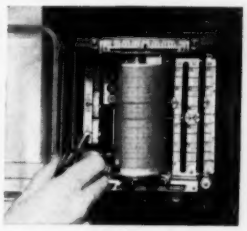
For full details of this unique new controller, see your Taylor Field Engineer, or write for **Bulletin 98332.** Taylor Instrument Companies, Rochester, N.Y., or Toronto, Ontario.

*Trade-Mark

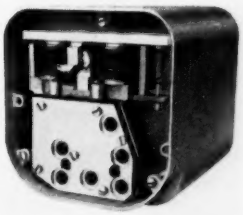
DESIGN FEATURES

- Plug-in construction.
- Response adjustment made from front or back of panel.
- Either field or panel mounting available.
- Uses standard TRANSCOPE* components.



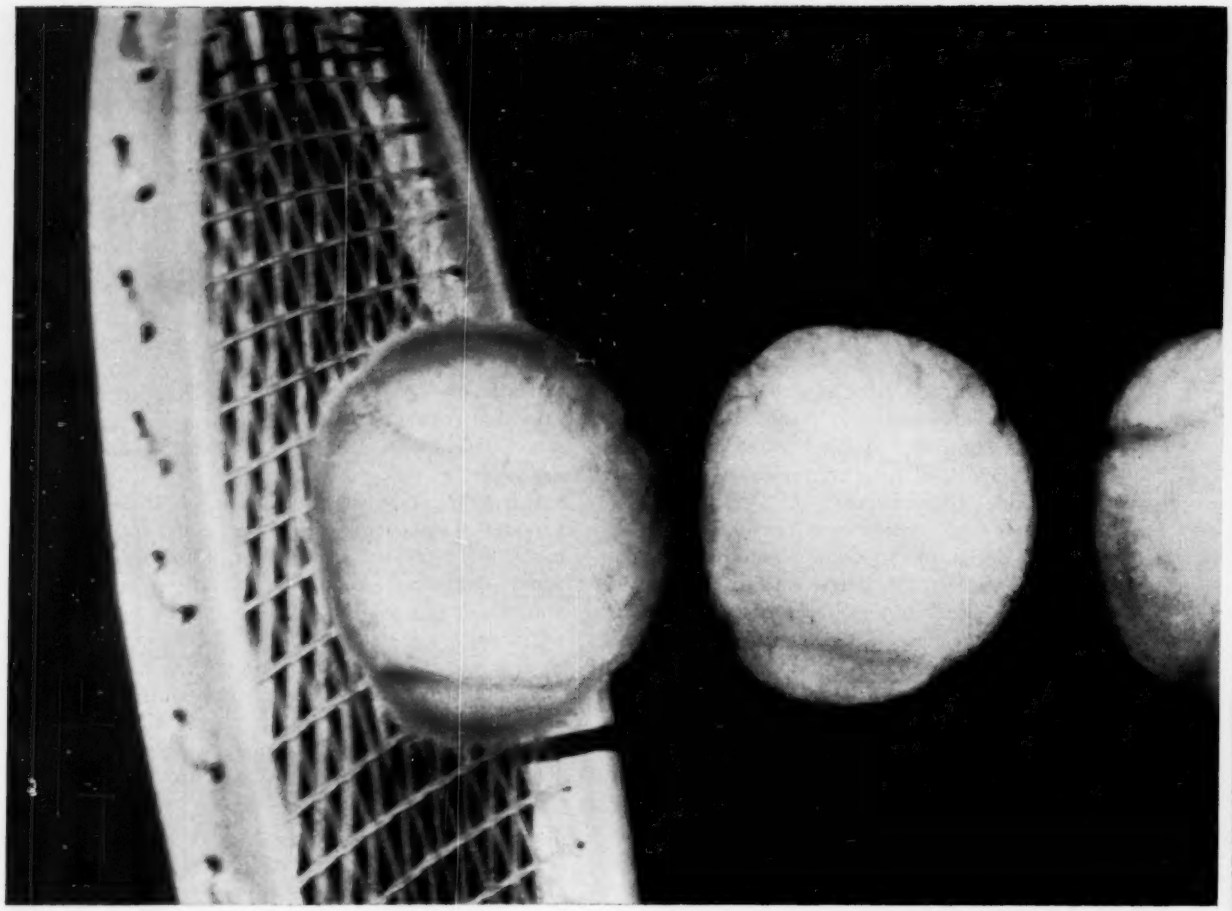


90J SERIES TRANSCOPE RECORDER

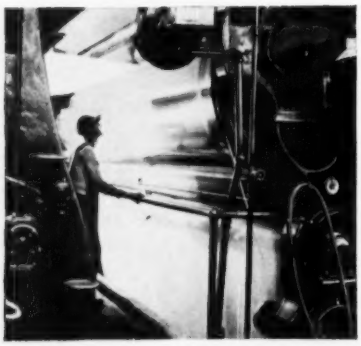


NEW 414RF TRI-SCOPE CONTROLLER

MEAN ACCURACY FIRST



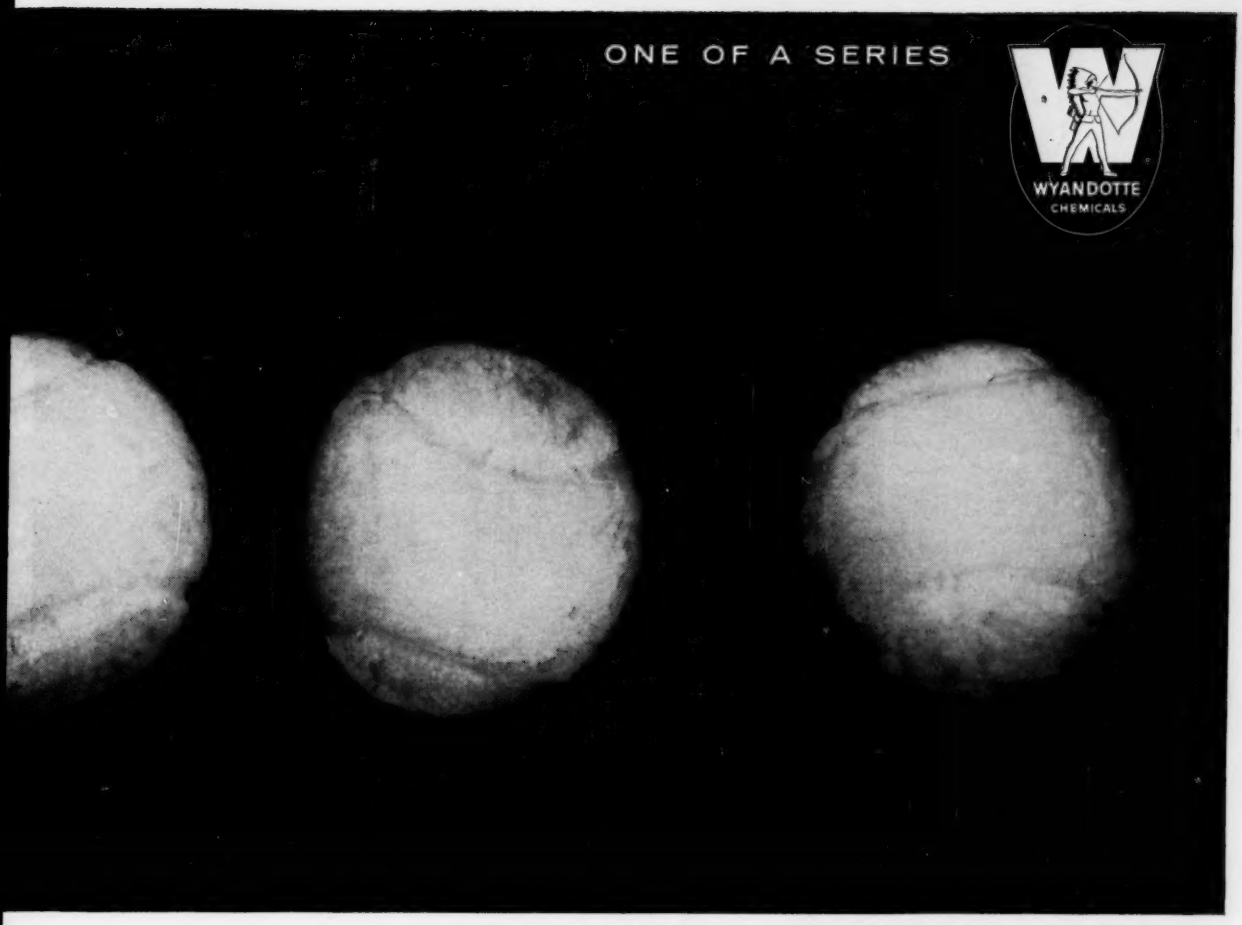
WYANDOTTE PURECAL®
makes countless things better because



A high-solids, low-viscosity PURECAL slip in coating colors improves coated-paper finishing properties.

Great fun for ducks, and kids in slickers. PURECAL in PVC paste helps make better fabric coatings.

PURECAL has proved an excellent carrier for insecticide dusts; ultrafine particle size provides bulk.



A fast serve depends, in part, on the "snap" in the ball. PURECAL puts more muscle in rubber by stepping up tear resistance, tensile strength, elongation and flex-life.

it's so pure, so white, so uniform

"Daddy – what makes a ball bounce?" A full answer to that one could fill a book . . . so chances are you'd just say, "rubber."

Actually, Wyandotte PURECAL SC is one of the things that can help a ball bounce better. This ultra-fine calcium carbonate has a chemically balanced coating developed for exact, uniform, controlled curing rate that also acts to upgrade modulus, "snap", and resilience in rubber.

What's more, PURECAL SC is only one-half point less bright than uncoated PURECAL . . . the precipitated calcium carbonate that is the whitest material in its class, thanks to Wyandotte's unique double-refining process. These qualities in uncoated PURECAL – plus the purity, accurate size and exceptional uniformity of its cubically shaped particles – mean that it makes countless things better, from pills and plastic toys to polishes and coated-paper stocks.

If your formulation calls for calcium carbonate . . . get the purity, whiteness and uniformity of Wyandotte PURECAL. Samples and data are available for the writing. Because PURECAL comes in various grades for specific applications, please include details on your requirements. *Wyandotte Chemicals Corporation, Department 10-E, Wyandotte, Michigan. Offices in principal cities.*

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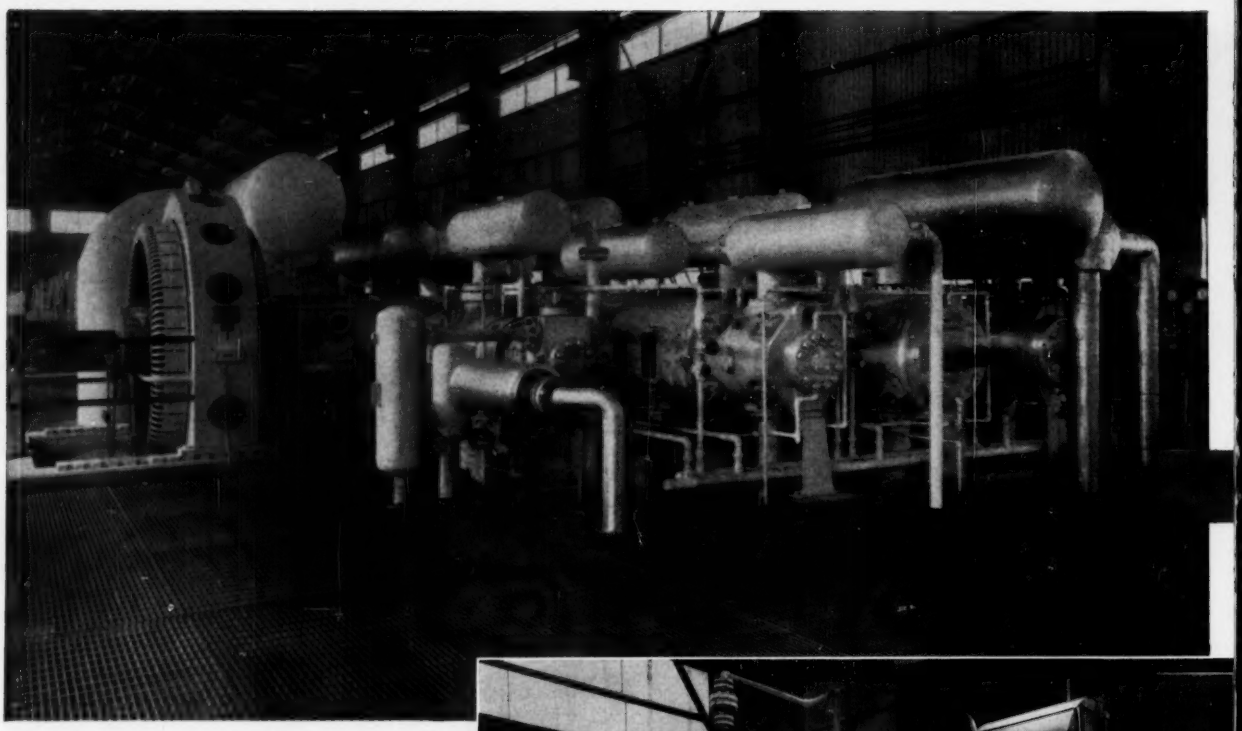
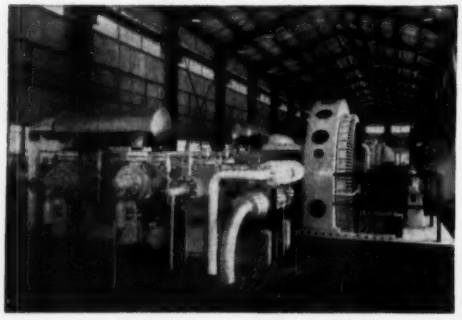
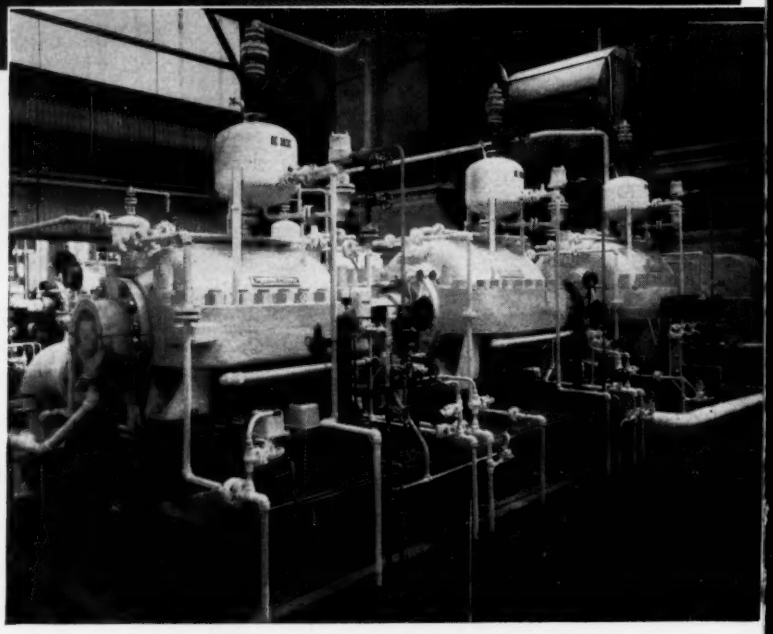
SYNTHETIC DETERGENTS (anionic and nonionic) • SODIUM CMC • ETHYLENE OXIDE • ETHYLENE DICHLORIDE • POLYETHYLENE GLYCOL • PROPYLENE OXIDE
PROPYLENE DICHLORIDE • POLYPROPYLENE GLYCOL • DICHLORODIMETHYLHYDANTOIN • CHLORINATED SOLVENTS • OTHER ORGANIC AND INORGANIC CHEMICALS



▲ Two 3500-hp HHE compressors in P.C.I. ammonia synthesis plant. Each 12-cylinder unit simultaneously compresses air and nitrogen, each in three stages; ethylene and high-pressure nitrogen, each in two stages; and low-pressure and high-pressure ammonia gas services, each single-stage.



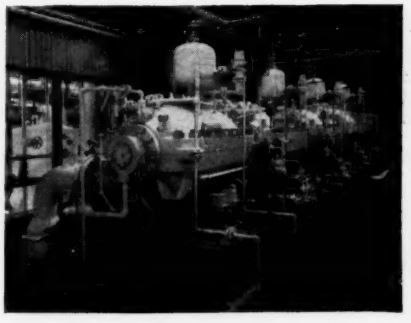
△ Two 3000-hp HHE hydrogen source gas compressors, each handling waste gases from Platformer, Hydroformer and butadiene plants, as well as ethane and methane residual gases, in eight separate compressor cylinders.



△ Train of three multi-stage horizontally-split centrifugal units compressing ethylene gas to 396 psi.

▷ Train of four multi-stage horizontally-split centrifugals with gas-turbine drive, compressing 10,750 cfm of hydrocarbon feed gas to 525 psi at the P.C.I. ethylene plant.

◀ Two 4000-hp HHE's compressing ammonia synthesis gas in four stages to 9255 psi.



Ingersoll-Rand compressors and pumps serve all production processes for

PETROLEUM CHEMICALS, INC.

Among the world's most ultra-modern processing plants are the new ammonia synthesis and ethylene units of Petroleum Chemicals, Inc., at Lake Charles, La. The adjacent Calcasieu Chemical Corp. plant, newly-built and operated by P.C.I., is a major producer of ethylene glycol. In all three plants, Ingersoll-Rand equipment plays the lead role in pressurizing and moving the gases and liquids that keep these processes going 24 hours every day.

8 RECIPROCATING COMPRESSORS in Ammonia and Glycol Plants

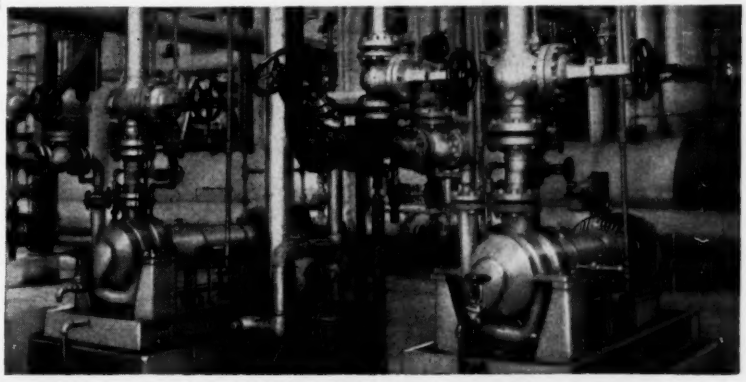
Six multi-stage Ingersoll-Rand electric-driven HHE compressors, totalling 21,000 hp, do all compression jobs in the P.C.I. synthetic ammonia plant. In the Calcasieu Chemical ethylene glycol plant, a four-stage HHE takes 80-psi air from an I-R centrifugal compressor and raises it to 2675 psi. A two-stage PHE compressor handles nitrogen.

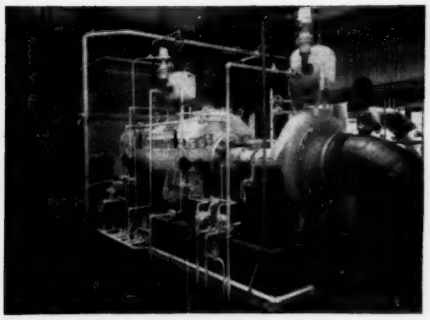
11 CENTRIFUGAL COMPRESSORS in Ethylene and Glycol Plants

Three trains of I-R centrifugal compressors (nine individual units) are at work in the P.C.I. ethylene plant. Each train is driven at approximately 7000 rpm by a 12,500-hp combustion gas turbine. In addition, there are two I-R centrifugals at the Calcasieu glycol plant: a multi-stage compressor discharging 80-psi air to the reciprocating unit mentioned above, and a single-stage blower boosting 8750 cfm of gas to 202 psig.

92 CENTRIFUGAL PUMPS in all three plants

The 92 Ingersoll-Rand pumps at Lake Charles include vertical and horizontal units in single- and multi-stage construction. They serve in all phases of production, handling cooling water, boiler feed water, light hydrocarbons and synthetic ammonia.





▲ Single-stage and multi-stage centrifugal compressors in tandem, handling propylene at 265 psi discharge.

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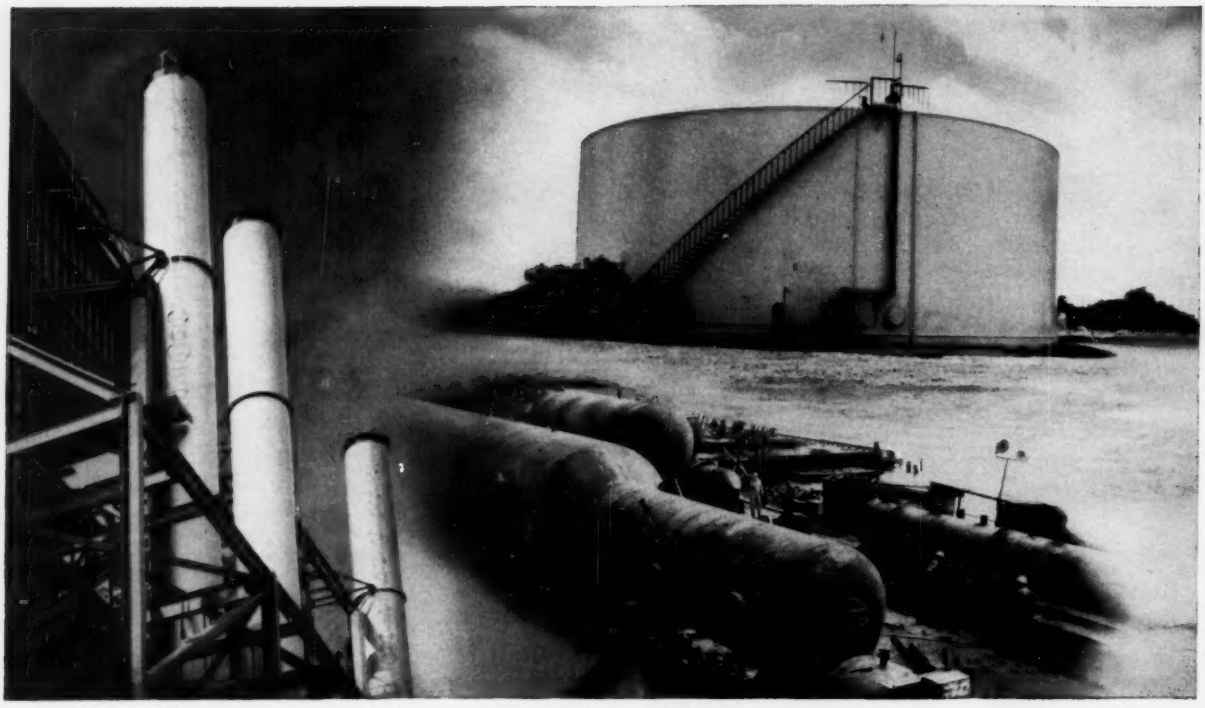
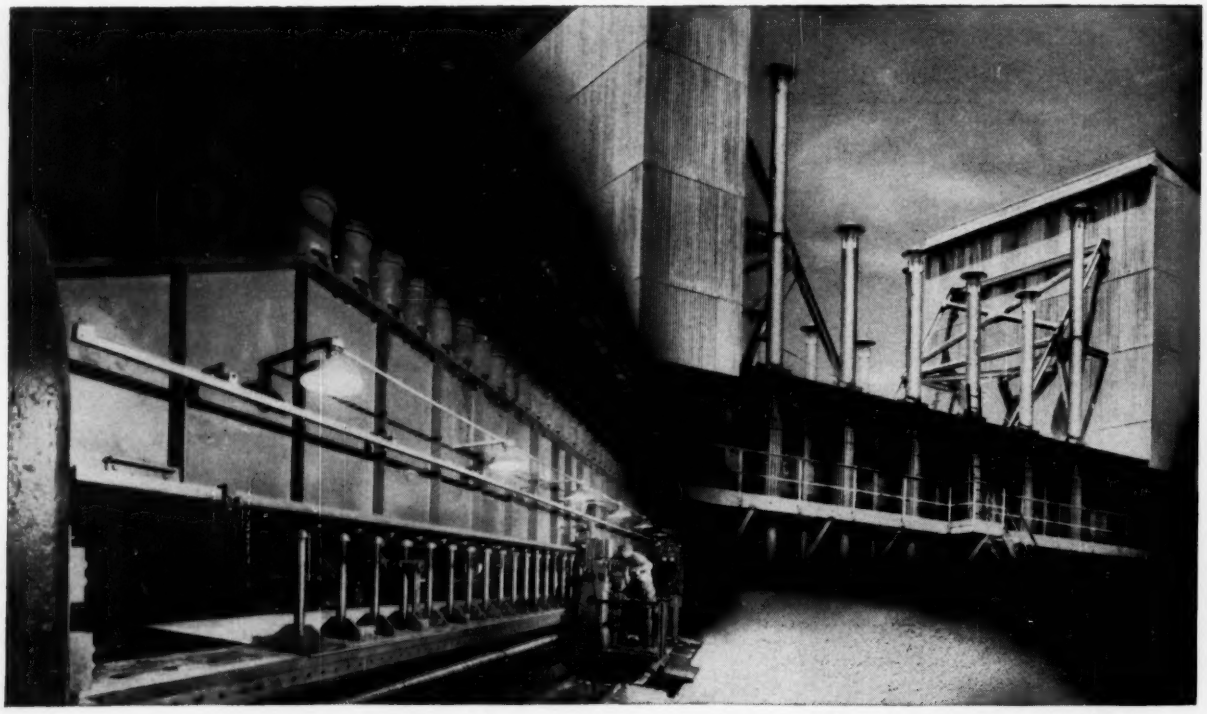


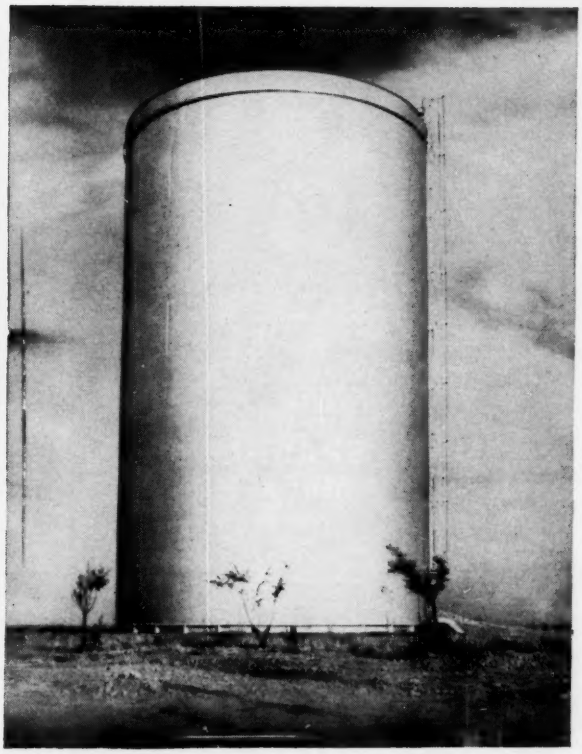
You name it, we'll make it; and erect it too!

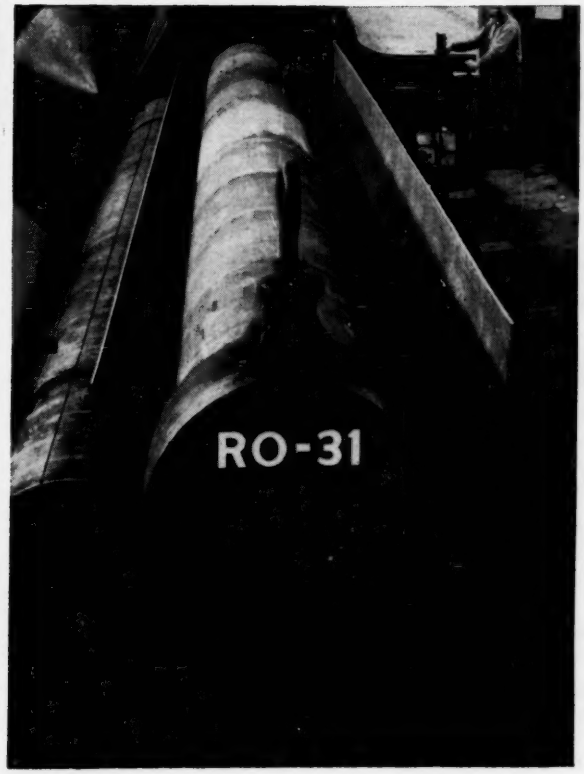


Complete, modern fabricating facilities.

Plate Fabrication

by American Bridge





OUR completely modernized fabricating plant at Orange, Texas, is now equipped to handle any type and size of custom plate work—from stacks, pipe, bins and tanks to heavy-wall pressure vessels.

And, because of its strategic location on water, rail, and truck routes, you can count on fast delivery and low shipping costs.

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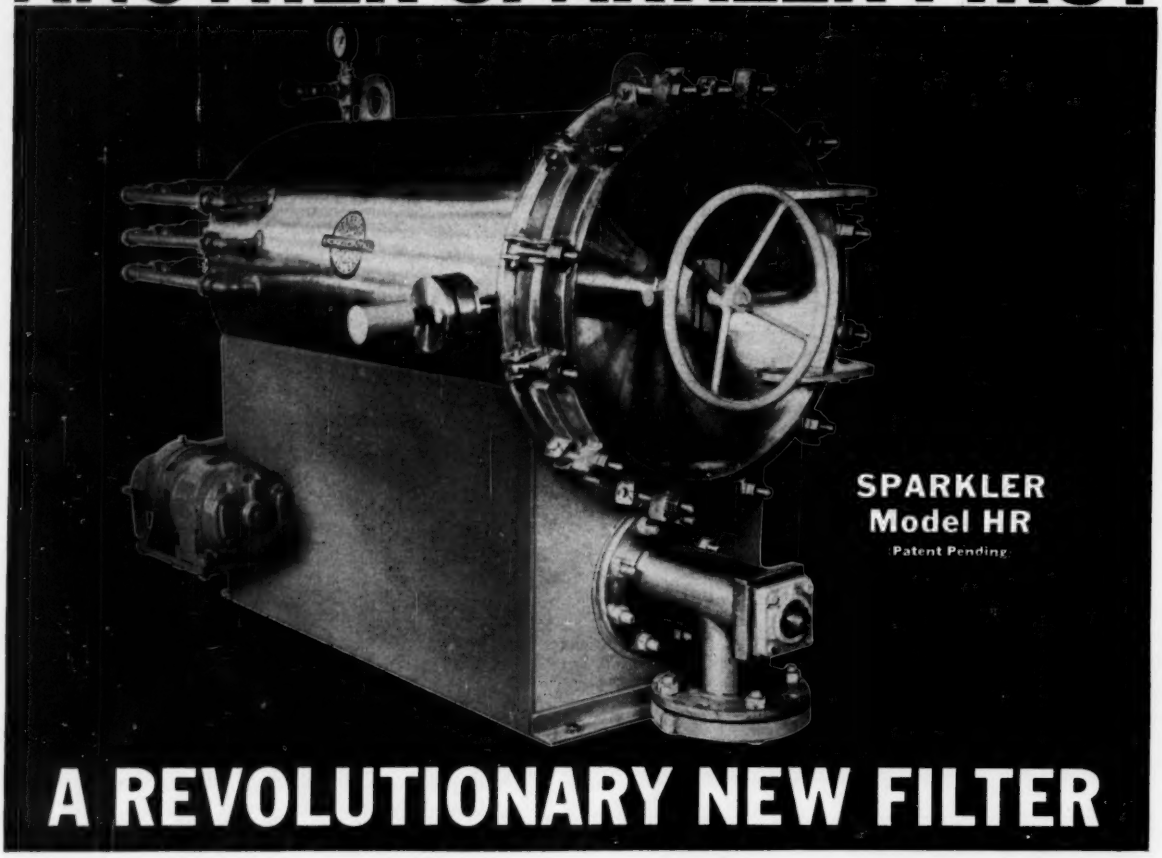

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This filter has all the operating features filtration engineers have dreamed of for years—Write for details.

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One of the largest of The Dow Chemical Company's manufacturing installations is the Texas Division, where, in complex and brilliantly-painted plants hundreds of different components are processed and re-shaped to produce more than 40 fundamental chemical products.

Chemical process condensers such as this at The Dow Plant, Freeport, Texas, are vital links in the production chain and are tubed with Cupro-Nickel, 30% Heat Exchanger Tubes.

Combining excellent corrosion-resistant properties with very favorable mechanical properties, Scovill Tubes of this alloy make an important contribution to the trouble-free operation of these key units under very exacting service conditions.

Let Scovill Technical Service . . . most experienced in the field . . . help you establish the best heat exchanger tube specifications for equally trouble-free service in your own heat transfer equipment.

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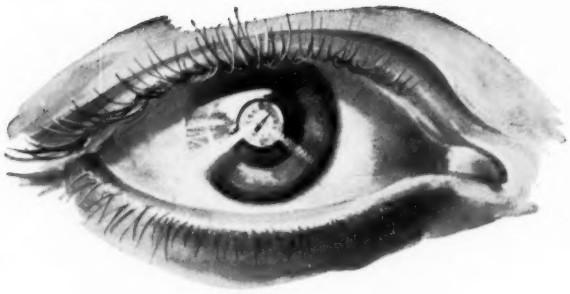

What you read is right

The new, patented Maxivision dial on American Bi-Metal Thermometers eliminates the perspective effect of usual pointer-above-dial construction. No parallax! Readings are sure, sharp and accurate – exact working temperatures are always right before your eyes. It is a two-level dial. A raised outer ring, set close to the cover glass, carries the graduations. The index type pointer is on the same plane as the outer ring, with the numerals on a lower level.

What you read is right when American Bi-Metal Thermometers with anti-parallax Maxivision dial are installed at important check points on your processing facilities. Mounting styles, dial sizes, temperature ranges and stem lengths are available to meet the most exacting requirements. Let your nearby industrial distributor help you select the best combination for each location.

American Bi-Metal Thermometer with Maxivision Dial. Suitable for indoor or outdoor service.

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Chemico venturi gas scrubbers have proved highly successful in solving air pollution problems in a wide variety of industrial applications. More than 400 venturi units have already been installed to clean up dust, fume and mist problems in the iron and steel, chemical, petroleum, metals, minerals, fertilizer and paper industries. Chemico's venturi scrubbers combine simplicity of design with very high efficiency—up to 99.95% in some applications.

Chemico Bulletin M104, illustrated here, gives a complete description of how venturi scrubbers operate and where they are now in use. Address your request for this brochure to Department GSE at the address below.

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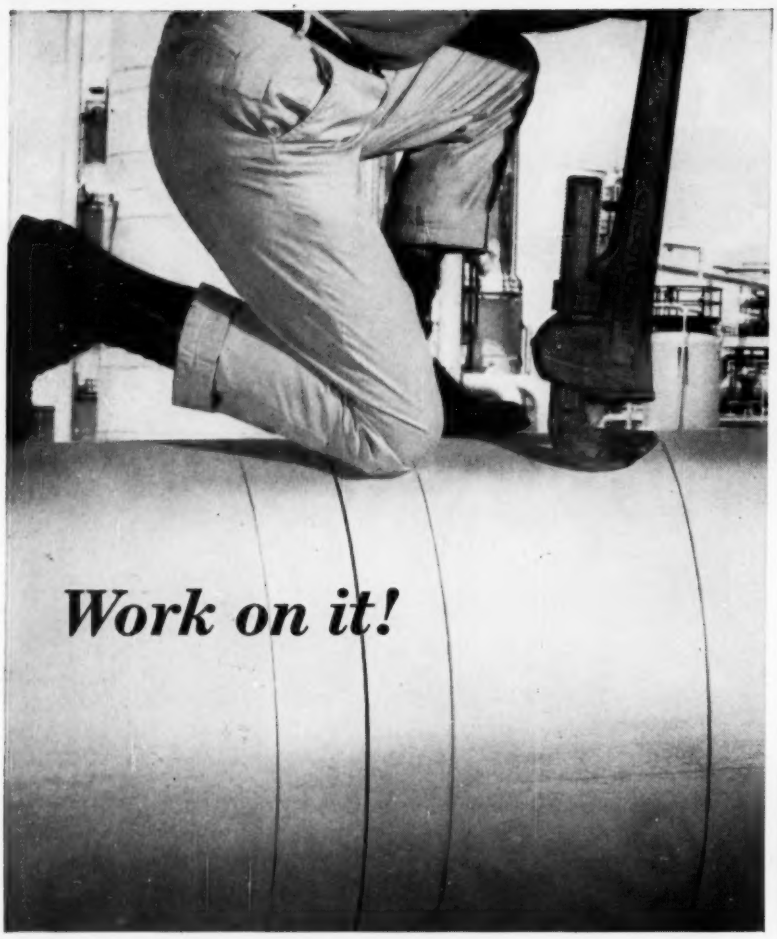


J-M's new Metal-On® insulation is Thermobestos prejacketed in aluminum. Snaps on pipe quickly . . . surely. Saves the time and cost of separate on-the-job metal application.

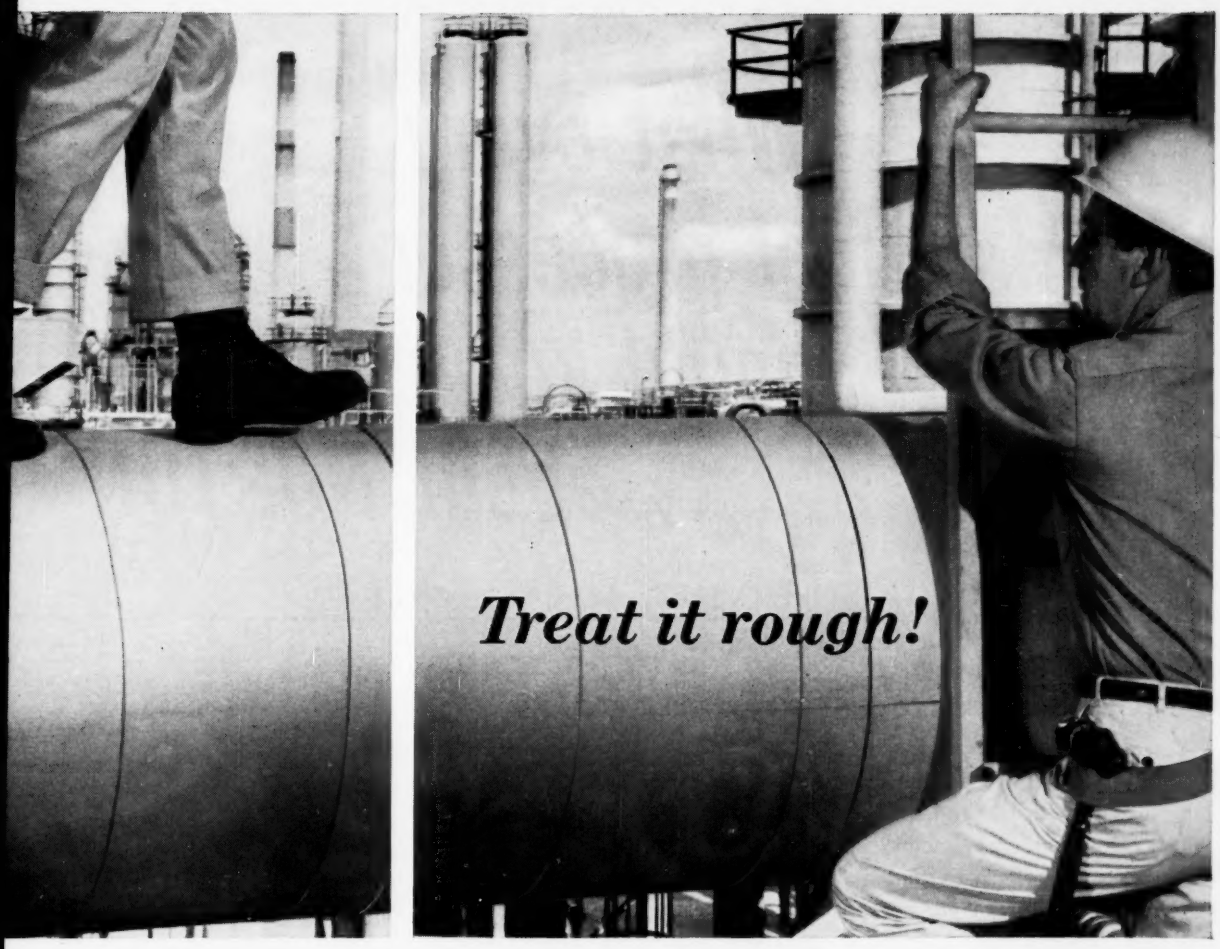
Seminars on best installation practices. For plant foremen who wish to keep up to date on new insulation methods and installation practices, J-M regional sales offices will gladly conduct insulation seminars. Contact nearest J-M office.

It's tough, durable Johns-Manville

Here's why Thermobestos is the preferred high-temperature calcium-silicate insulation . . . to 1200 F

You know the kind of treatment pipe insulation must take . . . day after day, year after year!

There's no better reason than this for the spiraling growth in Thermobestos® applications throughout the process and power generation industries —an insulation so strong and rigid, so resistant to crushing and compression it is almost structural.



THERMOBESTOS insulation!

Equally important is the ability of Thermobestos to keep fuel costs low. Its k factor is the lowest of all insulations generally accepted for process applications. Its moisture resistance, unsurpassed.

Furnished in large, lightweight sections—precision-molded to unusually close tolerances—Thermobestos is easy to handle and install . . . readily adaptable to shop fabrication of fittings and bonds. Large selection of sizes, thicknesses (and quads up to 33″ pipe size) permit calcium-silicate installations that are entirely Thermobestos insulation.

You'll want the new Thermobestos booklet for your technical file. It contains complete information on prefabricating and installation practices . . . specification data . . . heat transmission tables . . . and physical and thermal characteristics. Write for it today. Ask for booklet IN-169A. Address Johns-Manville, Box 14, New York 16, N.Y. In Canada, 565 Lakeshore Rd. East, Port Credit, Ontario.

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JOHNS-MANVILLE

What every chemical processor should know ...about NORTON

You can meet a *wide* variety of chemical and petrochemical processing requirements efficiently and economically with NORTON Products. They're more than just outstanding refractory materials. In addition, they provide versatile combinations of chemical, physical, and electrical properties that make them valuable aids at many critical stages of production. Find out how these advanced materials from the NORTON electric furnaces can help *your* operations by substantially improving process and product . . . sharply reducing operating costs. If you wish, the NORTON Man will be happy to discuss processing problems with you at any time. Backed by years of experience in the field, he's well qualified to help. Write NORTON COMPANY, Refractories Division, 505 New Bond Street, Worcester 6, Massachusetts.

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SHAPES	*MATERIALS*	*POROSITY*
Spheres	Alumina	from 10% to 50%
Rings	Silicon Carbide	
Pellets	Fused Magnesia	*Surface Area*
Granules	Zirconia	
Powders	Silica, Zircon	From less than 1
	Magnesia-Alumina	to 70 M^2/gram*
	Spinel, etc.	

Bulletin No. 7 gives full details. *BET Method

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A wide selection of porous media for filtration, diffusion, or aeration. Made of strong, chemically stable ALUNDUM* fused alumina, they also have high resistance to alkalies and acids. Provide uniform flow, with pores uniformly distributed in needed sizes and open-pore ratios. Tubes, plates, discs. Catalog No. 140 provides details.

FOR NUCLEAR WORK

Control and shield materials, including highly stable, lightweight NORBIDE* (B_4C). Metallurgical processing refractories. Ceramic fuel pellets. Source and intermediate materials.

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Castables: Highly versatile, easy-to-handle ALUNDUM fused alumina materials for insulation. Provide protection up to 3300°F. Shipped dry in moisture-protective bags, they can be mixed in minutes. Small, lightweight bubbles or dense grains. Bulletin 1992 offers details.

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products

Ceramic Spray Coatings: Hard, crystalline materials which can be applied to a wide variety of base materials to provide thermal or electrical insulation, add mechanical strength, improve resistance to wear, corrosion, and chemical activity. ROKIDE* "A" aluminum oxide; ROKIDE "ZS" zirconium silicate; ROKIDE "Z" zirconium oxide. Bulletins available.

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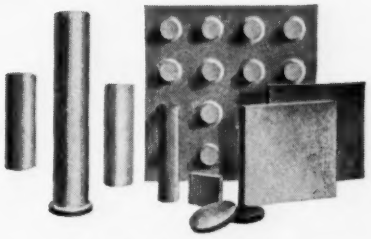
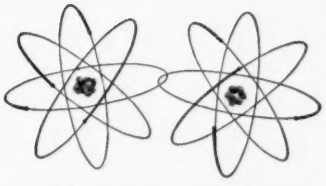
ALUNDUM ware has been used successfully for many years in laboratory development, experimental and analytical work involving filtering, extractions, melting, incineration, etc., because of its chemical resistance and stability in contact with reagents and solvents. Write for Catalog 793.

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

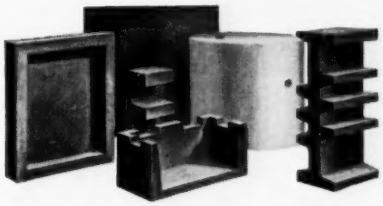
FOR CATALYSIS



FOR FILTRATION



FOR NUCLEAR WORK



FOR HIGH TEMPERATURE PROCESSING

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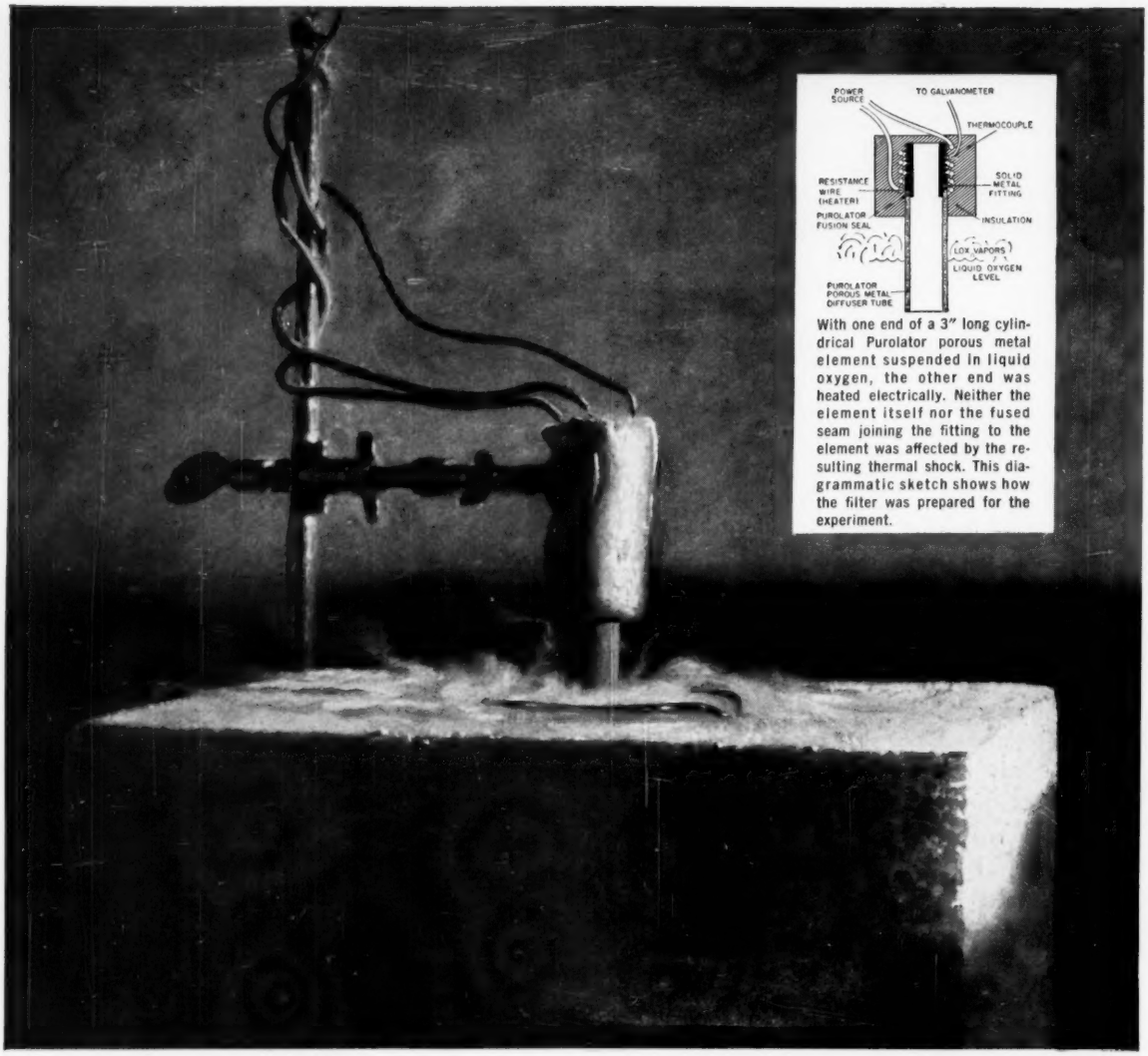
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



With one end of a 3" long cylindrical Purolator porous metal element suspended in liquid oxygen, the other end was heated electrically. Neither the element itself nor the fused seam joining the fitting to the element was affected by the resulting thermal shock. This diagrammatic sketch shows how the filter was prepared for the experiment.

Filters for extreme conditions . . .

THERMAL SHOCK

Purolator metal filter media can take it

How much thermal shock can a filter withstand?

In a recent series of experiments, various samples of Purolator metal filter media stood up under temperature gradients, across short lengths, of up to 500°F...and could have taken more. There was no effect on filter efficiency.

Thermal shock is only one of the difficult operating problems Purolator's staff of "Q" and "L" cleared-filtration experts handle regularly. They can design and produce the exact filter needed to remove any known contaminant from any known fluid under any operating conditions. They have produced filters and separators to operate within the following wide ranges of conditions:

TEMPERATURES: from −420° to 1200°F.

PRESSURES: from a nearly perfect vacuum to 6,000 psi.

RATES OF FLOW: from drop by drop to thousands of GPM.

DEGREES OF FILTRATION: from submicronic to 700 microns (in various media).

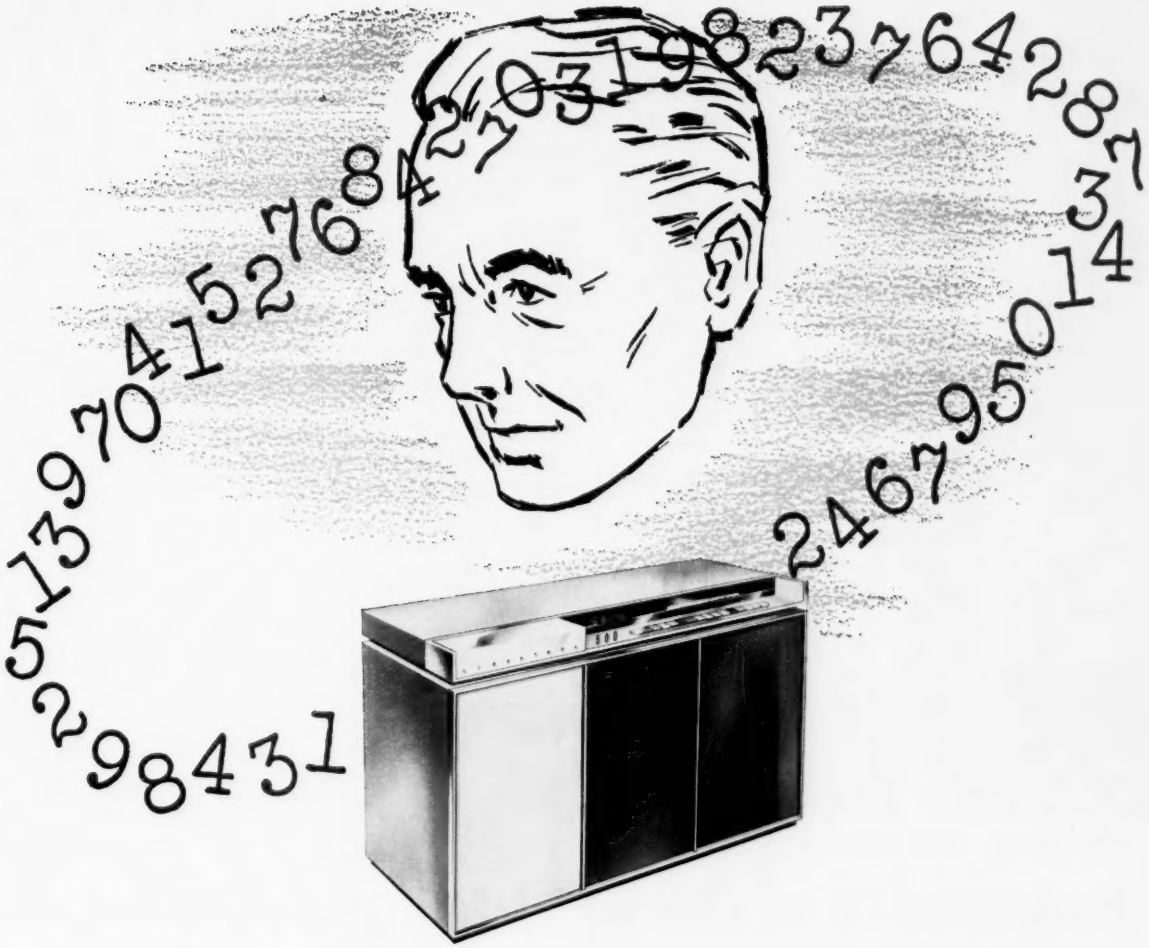
No other filter manufacturer can offer such complete services to handle so wide a range of tough operating conditions. These brochures outline what Purolator can do for you, or, if you have an urgent filtration problem, call Jules Kovacs, Vice President in charge of Technical Sales... or send him the details of your application.

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA



GPE Controls LIBRATROL-500

...anyone with a head for figures can program this digital computer for on-line application!

Any accountant or engineer – anyone who can work out a sequential problem on an ordinary desk calculator – can program the GPE Controls Libratrol-500. It is by far the easiest digital computer to program and operate.

For example, command and address data are a part of every word. This arrangement insures accurate programming without a great deal of specialized knowledge and training. An engineer can learn to program a simple problem in two hours.

Libratrol-500 was designed for industrial automatic control–designed for simple yet comprehensive operation. Your GPE Controls man can give you all the facts.

Test vehicles and pilot plants as well as industrial processes can benefit from the flexibility and simplicity of the Libratrol-500.

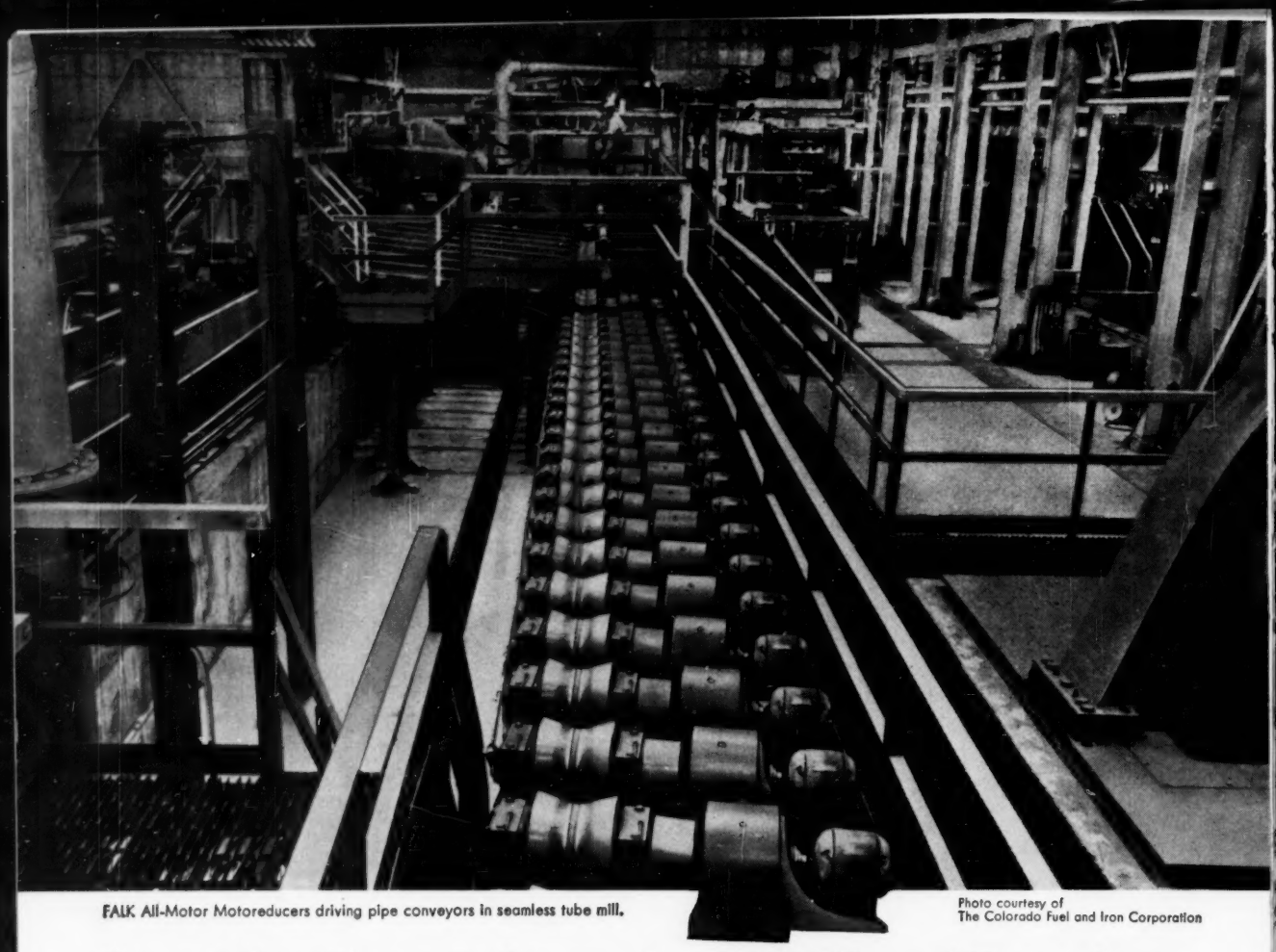
See the Libratrol-500 IN ACTION at the 5th World Petroleum Congress Exposition, Booth 376, New York, June 1-5

Write for descriptive literature

GPE Controls, Inc. (formerly Askania Regulator Company)
240 East Ontario Street • Chicago 11, Illinois

GPE Controls — A GENERAL PRECISION COMPANY

A Subsidiary of GENERAL PRECISION EQUIPMENT CORPORATION



FALK All-Motor Motoreducers driving pipe conveyors in seamless tube mill.

Photo courtesy of
The Colorado Fuel and Iron Corporation

You get these "extras" when you buy FALK *all-steel* Motoreducers

1. **Freedom from damaged housings.** The exclusive FALK *all-steel* construction gives full protection from cracked housings or torn-off feet...plus twice the ability of cast iron to maintain vital alignment.

2. **12-15% reserve load-carrying capacity** in the gears, by AGMA standards. The extra-depth, high pressure angle helical gears are another FALK exclusive ...they assure better operation and longer gear life.

3. **Highest known gear efficiency**—98½% per gear train under full load! This means maximum productive work for your power dollar.

4. **Longer service life**...advanced FALK design makes it possible to machine both bores for each shaft assembly at one time, thus eliminating possible accumulation of tolerances that occurs when individually machined parts are assembled. The result—better alignment of revolving elements that permits units to transmit rated capacity longer.

5. **Standard units to fit your needs.** Integral and All-Motor® Motoreducers are available in horizontal, vertical and right angle types...a type for every use.

Units are available up to 75 hp; output speeds from 780 rpm down to 1.2 rpm. Prompt delivery from factory, warehouse or distributor stocks. Ask your FALK Representative or Authorized FALK Distributor for *Bulletin 3100.*

THE FALK CORPORATION, MILWAUKEE 1, WIS.

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

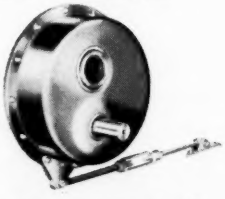
Representatives and Distributors in most principal cities

FALK

...a good name in industry

THE FALK ALL-MOTOR® MOTOREDUCER
the original All-Motor unit

(Shown) Horizontal concentric model. Also available in right angle and vertical types.



THE ALL-STEEL FALK® SHAFT MOUNTED DRIVE

Proved best for the countless industrial applications where a reducing unit mounting directly on shaft of the driven machine is indicated.

Units from 1/2 to 50 hp. Ratios —4:1, 14:1 or 24:1. Torque capacity up to 41,000 lb-in (in standard units). Prompt shipment from stock. For details, ask for *Bulletin 7100.*

New King-Sized DUMPMASTER Automatically Collects and Hauls Up To 120 cu. yds. of Refuse per Trip

Shown above is the Dempster-Dumpmaster CA30-24DB model which has a capacity of 100 cubic yards of loose refuse material.

Shown above is the CA15-18DB which has a capacity of 72 cubic yards of loose refuse material.

DEMPSTER BROTHERS' Newest Addition Cuts Waste Disposal Costs

The famous DEMPSTER-DUMPMASTER 24 DB now has a big brother in the CA60-30DB model. Like the original Dumpmaster, it automatically handles detachable containers in one through six cubic yard sizes. However, it can pick up a gross load of 6000 pounds as compared to the 24DB's 3000 pound capacity.

Another important difference in capacity—the new model can compact up to 120 cubic yards of loose refuse while the 24DB gets up to 100 cubic yards per trip. Like all Dumpmasters, the new 30DB has clearance arms for safety . . . they never pass the cab windows . . . can't injure the operator.

Write today for FREE BROCHURE

The Originator and Only Manufacturer of the

Patents Pending

DEMPSTER BROTHERS Inc.

DEMPSTER DUMPSTER® SYSTEMS

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News from
National Carbon Company
Division of Union Carbide Corporation • 30 East 42nd Street, New York 17, N. Y.
Sales Offices: Atlanta, Chicago, Dallas, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco. IN CANADA: Union Carbide Canada Limited, Toronto

National Carbon representatives expand your engineering force

D. S. GLASS—SALES ENGINEER

Mr. Glass graduated from Illinois University with a B.S. Degree in Chemical Engineering. For three and one-half years, he worked in the midwest as a process engineer with a petroleum additive manufacturer.

He has been with National Carbon Company since 1953. He has worked on the development and design of chemical process equipment, prepared technical design proposals and worked directly with users on the installation of carbon, graphite and "Karbate" impervious graphite equipment. Since late 1958, he has been a field engineer covering the northeastern states.

Long, Dependable Service provided by "Karbate" Process Equipment

Two 700 sq. ft. "Karbate" condensers, three "Karbate" pumps Model A and several 2" size "Karbate" valves have been used continuously since 1952 in steam distillation of a xylene and dilute hydrochloric acid mixture.

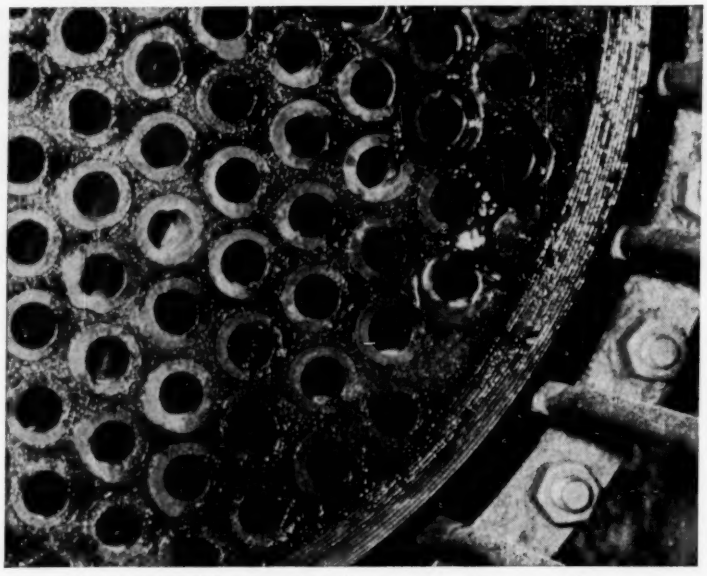
Records show the condensers have operated without maintenance since installation. In addition, a recent consideration to convert "Karbate" Model A pumps to the present standard Type C Model CA pumps could not be justified because of the excellent service records provided by the installed pumps.

NATIONAL TRADE MARK

"National", "Karbate", "N" and Shield Device and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

UNION CARBIDE

"KARBATE" REBOILERS OPERATE 12 YEARS WITH LOW MAINTENANCE COSTS



Tube sheet of a reboiler in service twelve years. Some replacement tubes are shown. Most tubes are original ones installed in 1946. Machining marks made in 1946 are visible on the impervious graphite tube sheet.

"Karbate" impervious graphite shell and tube heat exchangers provide economic service life as reboilers handling 45-55% sulfuric acid-organic solution. Sixteen of these reboilers were installed by a major chemical company in 1946.

The sulfuric acid flowing through the tubes of the reboilers contained contaminants. Eventually, stubborn carbonaceous deposits formed inside the "Karbate" impervious graphite tubes and had to be removed periodically. This was done mechanically by drilling and sandblasting techniques.

	1950-1953	1954-1957
REBOILERS CLEANED (per year)	20	2
REBOILERS REPAIRED (per year)	23	9

To check performance of these units, records were kept starting in 1950 covering both cleaning and repairs.

The drop in both cleaning and repairs after 1953 is related to a modification in the process which substantially reduced carbon deposition on the tubes. The average cost of maintenance, including parts and labor for repairs and cleaning over the twelve year period, has been less than $500 per exchanger per year.

The user feels this cost is economic considering the inherent difficulties associated with this application. In other processes in this plant, "Karbate" impervious graphite exchangers which were installed approximately ten years ago are still operating without any maintenance. These units are handling corrosive chemicals at 140°F and 25 psig. pressure.

FLAMMABLES ENGINEERING BY PROTECTOSEAL

FLAMMABLES CONTROL METHODS AND PRACTICES IN PRODUCTION, PROCESSING AND IN MAINTENANCE

PUBLISHED BY THE PROTECTOSEAL COMPANY, CHICAGO, ILLINOIS • WAREHOUSES: CAMDEN, N. J.; LOS ANGELES, CALIF.

WHAT'S NEW . . .

PROTECTOSEAL DRUM VENT FOR END BUNG INSTALLATION

The Protectoseal Catalog No. 5522 Drum Fitting is a fire and explosion-safe, pressure-vacuum relief vent for installation in the 2" end bung openings of drums stored in the horizontal position. Automatic pressure relief valve opens at 5 lbs. p.s.i. to relieve interior vapor pressure build-ups, and new fusible emergency relief plug melts at 135°F to provide emergency relief in the event of fire. Quick-acting, manually operated vacuum relief valve facilitates withdrawal of liquids. All vent passages are protected with a perforated metal fire baffle to prevent the propagation of fire and explosion into the drum.

For Further Information Circle Item 15 on Coupon

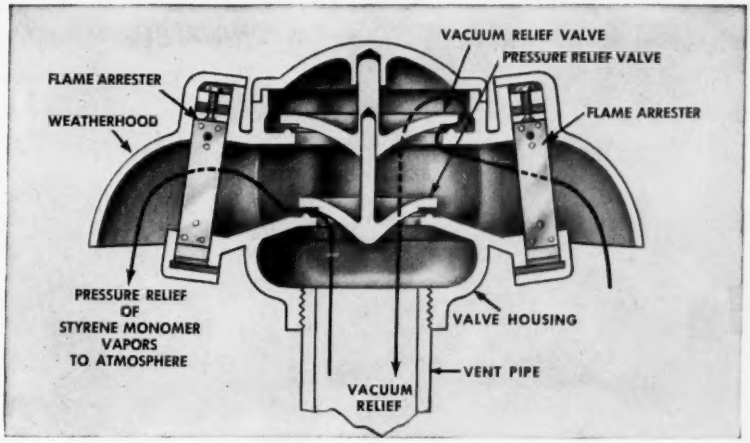
Flammables Storage Cabinet earns 3 more approvals

The Protectoseal Flammable Liquids Safety Storage Cabinet, designed to meet the specifications of the N.F.P.A. for on-the-job storing of up to 45-gallons* of flammables, has recently been approved by 3 more official agencies: National Fire Protection Assn.; Board of Standards and Appeals for City of New York; Pennsylvania State Police, Bureau of Fire Protection. Cabinets will now carry all 3 approval labels on the front doors.

*When stored in approved safety containers of not more than 5-gallons capacity each.

For Further Information Circle Item 11 on Coupon

Styrene monomer vapors controlled to reduce vent clog-up...prevent tank rupture



Chemical manufacturer stores styrene monomer in 30,000 gallon horizontal tanks at atmospheric pressures and temperatures. Plagued by polymerizing which clogs flame arrester vents . . . flash point of 90°F requires protection against ignition of vapors from outside sources. Tried various means to keep arresters open without success . . . installed Protectoseal conservation type vent with flame arrester located outside the valve housing . . . arrester now subject to vapors only when valves open. Result: checked weekly during 11-month period . . . including hot summer months . . . report no plugging of valves or arresters . . . tank protected against fire and explosion . . . arrester location outside valve housing provides for quick, visual inspection.

For Further Information Circle Item 17 on Coupon

Safety space-savings in chemicals handling

Oval shape, 1-gallon laboratory safety container requires far less shelf space for chemicals storage . . . four cans easily placed in same area required by two or three ordinary cans. Protects volatile chemicals from fire and explosion... provides easy method for storage and visual labeling.

For Further Information Circle Item 18 on Coupon

FLAMMABLES ENGINEERING DATA FOR THE CHEMICAL PROCESS INDUSTRIES

The following Protectoseal Flammables Engineering Data is available immediately, without obligation:

- ☐ Storage Tank Safety Vent Fundamentals
- ☐ Manual of Laboratory Safety Equipment

More Information on Items Circled Below:
11 15 17 18

THE PROTECTOSEAL COMPANY
1948 SOUTH WESTERN AVENUE
CHICAGO 8, ILLINOIS

Name _____

Title _____

Company Name _____

Address _____ City & State _____

FINE PRODUCT CONTROL

is easier with a LJUNGSTROM® AIR PREHEATER

—and finer control means a more uniform, more profitable product

Income is up $58,000 a year at one East Coast refinery because Ljungstrom Air Preheater permits finer control and advanced design units. This boosts average product ratings *as much as two octane numbers.*

The most modern heat transfer system can be operated at peak efficiency with a Ljungstrom gas-to-gas regenerator. A Ljungstrom can recover as much as 1000°F heat from the exhaust of stills or boilers. Instead of letting this heat escape up the stack, the Ljungstrom returns it to the furnace combustion air.

Hotter combustion air can boost the output of a pipe still, too—by as much as 25%. Or, it can cut your fuel bill by an equal amount—or permit you to use cheaper fuels that were previously considered useless. And whatever fuel you use, there's less slag, fewer deposits, because a Ljungstrom Air Preheater helps burn fuel more completely. Some plants have "written off" the cost of their Ljungstroms *in only nine months.*

THE AIR PREHEATER CORPORATION

Here's documented evidence. One company's fuel savings with a Ljungstrom Air Preheater are factually described in a published magazine article by O. F. Campbell. A reprint of this case history is yours free. Simply write:

60 East 42nd Street, New York 17, N. Y.

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what's
new
in

metering pumps

new streamlined safety shield
new crank-type design
new improved accuracy
new parts interchangeability
new operational efficiency
new maintenance ease

all for a new lower price

Send for new booklet giving the biggest news in pumps...

See how the all-new Hills-McCanna Masterline metering pump can bring you new highs in economy and performance. This booklet tells the story . . . gives you the details on the pumps that go new *inside* and *outside* to register all-time highs in accuracy, dependability and maintenance ease.

Ask for Bulletin #900 "Look What's New in Metering Pumps". . . it pinpoints the features that make Masterline pumps your best buy for now and the *future!*

Hills-McCanna Company, 4568 W. Touhy Ave., Chicago 46, Ill.

hills-mccanna company

THE PEOPLE WHO KNOW AND CONTROL FLOW

Now...you can have Grinnell-Saunders Diaphragm Valves of

Ductile Iron with Glass-Lined Bodies

After long research, Grinnell has available top quality, corrosion-resistant glass lined bodies for its line of rugged ductile iron valves.

EXTRA TOUGHNESS The greater toughness of ductile iron resists impact, torsion, line strains and thermal shock. Grinnell-Saunders valves of ductile iron handle severe service requirements where both internal and external impact shocks may be expected, and where piping stresses from rapid heating and cooling occur.

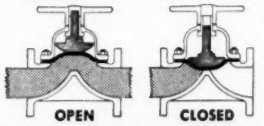
ECONOMY Approved and used by leading industries, ductile iron offers many of the benefits of cast steel at a lower price.

Of particular importance to users of Grinnell-Saunders valves is that ductile iron bodies can now be *glass-lined*—a procedure not practical with cast steel bodies.

WIDE SELECTION Body linings: glass, rubber, neoprene. Diaphragms: soft natural rubber, natural rubber, white synthetic rubber, neoprene, reinforced neoprene, butyl, Hycar, Teflon, Kel-F, PVC (polyvinyl chloride), polyethylene. Bonnet materials: ductile iron, grey iron. Bonnet styles: handwheel (non-indicating stem or indicating stem), chain wheel, lever for quick operation, and sliding stem for a wide selection of power operated topworks.

Important features of the Grinnell-Saunders Diaphragm Valve

- Diaphragm completely isolates operating mechanism from the fluid in the line
- Diaphragm lifts high for full, streamline flow in either direction
- Diaphragm effects positive, leak-tight closure
- Diaphragm easily replaced without removing valve body from the line



GRINNELL-SAUNDERS DIAPHRAGM VALVES

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

VARSOL®

Look to Varsol for the latest quality improvements in mineral spirits. This top-grade Esso solvent is now produced with *new* refining techniques and finished to *new* levels of odor and volatility. Here is a real advance: Varsol – a dependable old standby – with *new* fresh odor and higher-than-ever quality! For technical assistance with your solvents problems, contact your nearest Esso office, or write Esso Standard Oil Company, Solvents Division, 15 West 51st Street, New York 19, New York.

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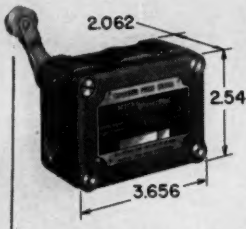
ESSO RESEARCH
Works Wonders With Oil

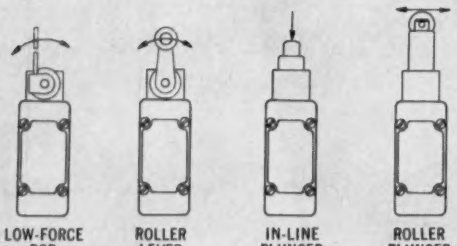
A COMPLETE FAMILY OF AROMATIC SOLVENTS FOR ALL OF INDUSTRY'S REQUIREMENTS. SOLVESSO 100 • SOLVESSO 150 SOLVESSO TOLUOL • SOLVESSO XYLOL

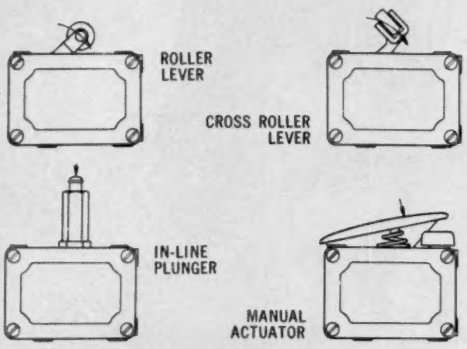
MICRO SWITCH Precision Switches

"ML-E1" SERIES
Give excellent protection in most industrial locations. Available in 4 actuator designs. Rated at 20 amperes.



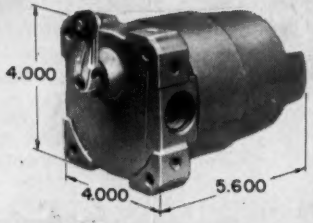
"EX" SERIES
Smallest explosion-proof switches available. Available in 4 actuator designs. Rated at 15 amperes.





Here are explosion-proof switches for chemical plant electrical controls

"EX1" SERIES
Two conduit openings—one at either end of the switch housing—permit through wiring, save cost and space.



"CX" SERIES
A weather-proof switch ruggedly housed to withstand outdoor conditions. Each of two SPDT switching units is operated by an opposite movement of the roller arm. Rated at 20 amperes.

These explosion-proof switches are ideal electrical controls in hazardous areas. They combine the ability to operate safely in explosive gas or vapor-air atmospheres with the desirable features of precise operation, accurate repeatability, small size, easy adjustment and durable construction. They are the most compact switches of this type available. All are Underwriters' Listed for Hazardous Locations Class I, Groups C and D; Class II, Groups E, F and G. (Send for Catalogs 83 and 84)

MICRO SWITCH explosion-proof switches are sold by distributors in key cities everywhere. See "Switches, Electric" in the Yellow Pages.

MICRO SWITCH . . . FREEPORT, ILLINOIS
A division of Honeywell
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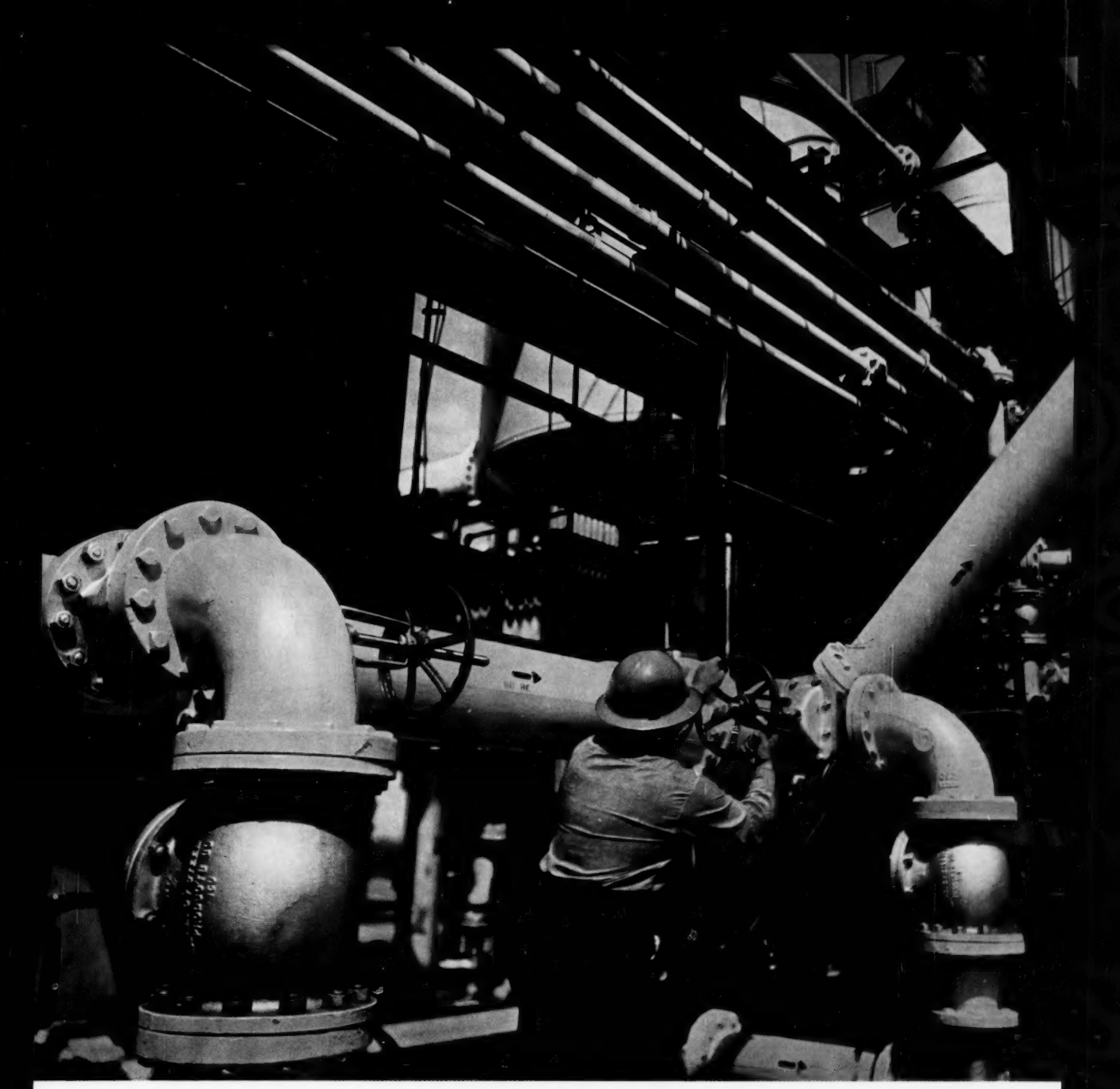
Honeywell
MICRO SWITCH Precision Switches



Aloyco Valves in General Chemical's new "dream" plant

The Aloyco Valves you see here are controlling the flow of 98% acid in the new sulfuric acid plant of General Chemical Division, Allied Chemical Corporation, at Elizabeth, New Jersey.

The plant utilizes most modern processing techniques. All equipment was chosen for its special ability to contribute to operating efficiency and long life.

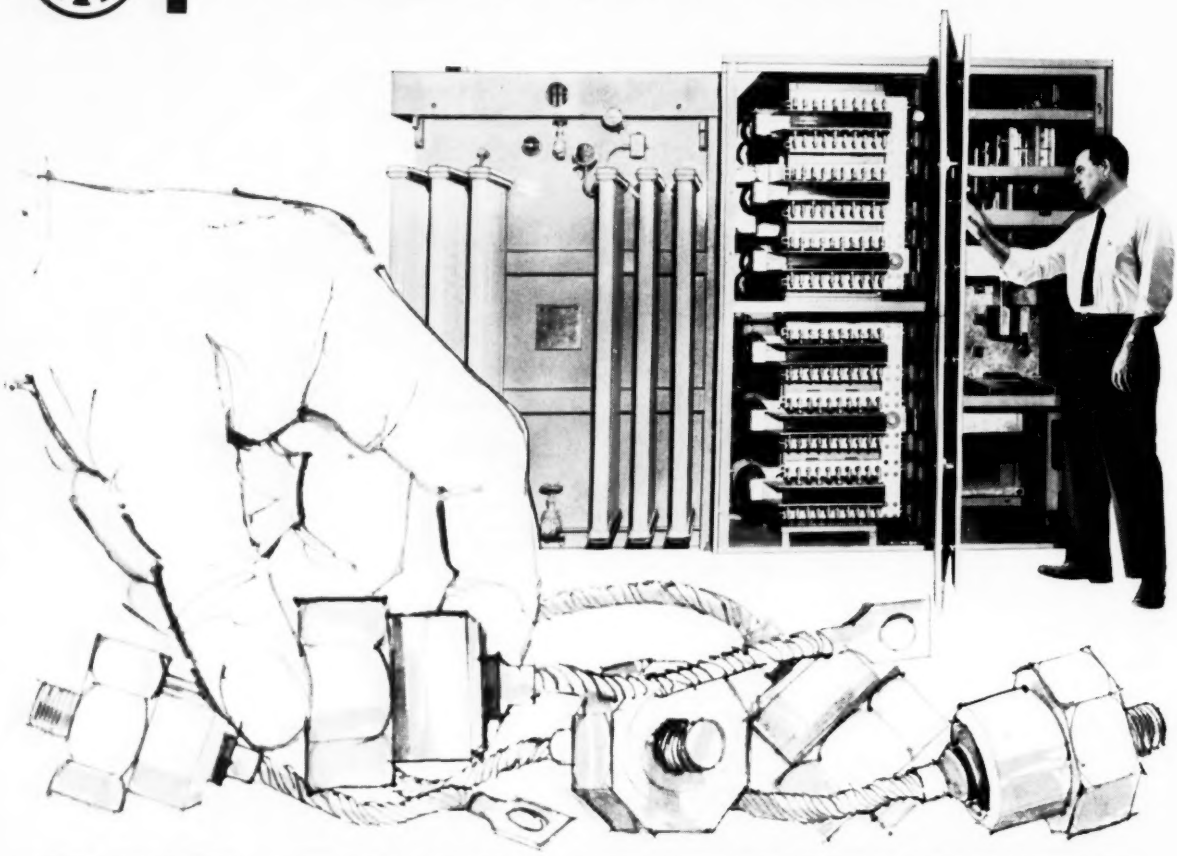
For example, valves made in Aloyco 20, an alloy exceptionally resistant to corrosion from sulfuric acid, were specified for handling spent and sludge acids, as well as finished strong acid and oleum.

When you are selecting valves for corrosive service, remember only Alloy Steel Products Co. specializes in Stainless Steel Valves exclusively. Call our local representative or write us at 1301 West Elizabeth Avenue, Linden, N. J. 9.2

ALLOY STEEL PRODUCTS COMPANY

Boston · New York · Wilmington · Atlanta · Buffalo · Pittsburgh · Chicago · St. Louis · San Francisco · Los Angeles

I-T-E CIRCUIT BREAKER COMPANY



THE ONLY RECTIFIER

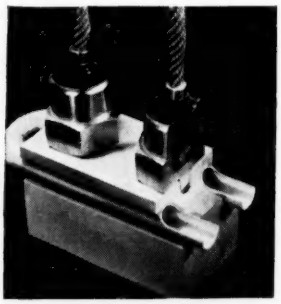
PERMITTING RANDOM CELL SELECTION

I-T-E Unitron Semi-Conductor Rectifier lets you use any cell in any position

Only the I-T-E Unitron Semi-Conductor Rectifier has this advantage. Instead of having to code cells for use in various positions, you can select them at random. The unique I-T-E voltage divider circuit maintains equal inverse voltage on all cells. So they have greater assurance of long life.

This ingenious voltage divider circuit uses no parallel-connected resistors that drain power. A small transformer does all the work. It takes no power and needs no maintenance. In case of a cell failure, sensing devices respond instantly and register the failure on the control panel.

Recent AIEE papers cover this and other features of the I-T-E Unitron Semi-Conductor Rectifier in considerable detail. For your copies and further information, consult your local I-T-E representative. Or write I-T-E Circuit Breaker Company, Transformer & Rectifier Division, 1900 Hamilton St., Philadelphia 30, Pa.



Unique cooling system . . . saves you money. Ordinary tap water is continuously purified and circulated close to cells. Picture of bus section at right shows how compactly this is done. No need to drain system to change cells.

ADVERTISEMENT—*This entire page is a paid advertisement* *Prepared by U. S. Industrial Chemicals Co.*

U.S.I. CHEMICAL NEWS

May ★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1959

First Technical Book On Aerosols Published

For the first time, complete information on packaging products in pressurized containers has been set down in one place — a 411-page book by Herzka and Pickthall titled "Pressurized Packaging (Aerosols)," now being sold.

Chapters give detailed information on propellents, containers, valves, filling methods, laboratory procedures, emulsion systems and perfumes. Graphs, charts and photos illustrate all chapters, which are followed by lists of literature references and significant patents.

Formulations — over 200 in all — are included, on a wide range of products from insecticides and paints to cosmetics, perfumes and foods. Appendices cover common abbreviations, technical terms, trademarks and trade-names, and aerosol producers throughout the world. The book is considered an extremely valuable reference for both research and development and management groups.

New U.S.I. Sales Office Opens in San Francisco

U.S.I. has established a San Francisco sales office, managed by Kenneth Fietz, who has been a representative of the company's New York Sales Division for the past 16 years. The new office, located at 220 Montgomery Street, was created to serve U.S.I. customers in central and northern California, Oregon and Washington. This office is tied in with U.S.I.'s automated communications system through Pacific Coast headquarters in Los Angeles. This will facilitate the processing of orders and messages by the company's offices and plants in all parts of the country.

H^3-Labeled Methionine Gives Clue to Protein Synthesis in Cells

In a recent study of protein synthesis in the cells of adult mice, DL-methionine labeled with tritium (H^3) was injected into test animals and then traced by radioautography methods. Results revealed that the most active protein synthesis involving methionine takes place continuously and independently within the cytoplasm and nuclear chromatin. Very little protein is synthesized from methionine in the nucleolus.

In this particular study, tritium was used as the tracer element because its low β-ray energy allows good radioautographic resolution. Previous investigations with S^{35}-labeled methionine had shown only that this amino acid is continuously being incorporated into protein in all cells. However, the exact distribution of synthesis in the nucleus and cytoplasm could not be determined up to this time because the high β-ray energy of S^{35} prevented good resolution.

U.S.I. Starts Up 75-Million-Lb. Polyethylene Plant at Houston

Low and Medium Density Resins Being Produced by High Pressure Process. Plans Already Underway to Double Capacity.

U.S.I.'s new high pressure polyethylene plant has just been put into operation at Houston, Texas, to make 75 million pounds per year of PETROTHENE® resins.

The Houston installation was rushed into production some six to eight weeks ahead of schedule when demand for PETROTHENE resins began to outrun supply late in 1958.

As a result of this demand, a major expansion is already being planned, to double the new plant's capacity and bring the company's PETROTHENE output in Houston to 150 million pounds of high pressure polyethylene per year. At Tuscola, Illinois, U.S.I. now turns out about 100 million pounds of polyethylene annually. Thus, when the planned expansion at Houston is completed late in 1960, total U.S.I. capacity will be 250 million pounds of high pressure resins per year. This will make the company the second largest polyethylene producer in the country.

The new plant is well situated on the Houston Ship Channel for shipment of resins by all means of transportation. Export shipments are facilitated by the extensive port facilities available in Houston. The new installation is assured of a plentiful supply of ethylene — the major raw material — from salt dome storage facilities.

MORE

Oils Solubilized in Alcohol By New Patented Technique

Drug and cosmetic manufacturers can now formulate water-clear, non-aqueous products containing both oils and low-molecular-weight alcohols, via a new solubilizing technique described in U.S. Patent No. 2,865,859 issued recently.

According to the patent, it has never been possible commercially to prepare cosmetic or industrial solutions containing these alcohols plus large quantities of oil. Layering has always taken place. The technique described makes miscibility possible by including low-molecular-weight aliphatic alcohol esters of high-molecular-weight fatty acids.

Mixtures of esters such as ethyl laurate, butyl myristate, amyl oleate, propyl linoleate or isopropyl palmitate are cited. The resulting solutions would contain 20-50% oil, 20-50% low alcohol and 5-20% ester. The oils may be of any class — animal, vegetable or mineral — and the alcohols preferably in the one to five carbon group, such as ethanol, methanol and isopropyl alcohol.

Suggested formulations are given for cosmetic compositions which are claimed highly stable over a wide temperature range for long periods, without separation. Examples include sun-screening compounds, hand lotions, hair preparations, soaps, colognes, antiperspirants and after-shave lotions.

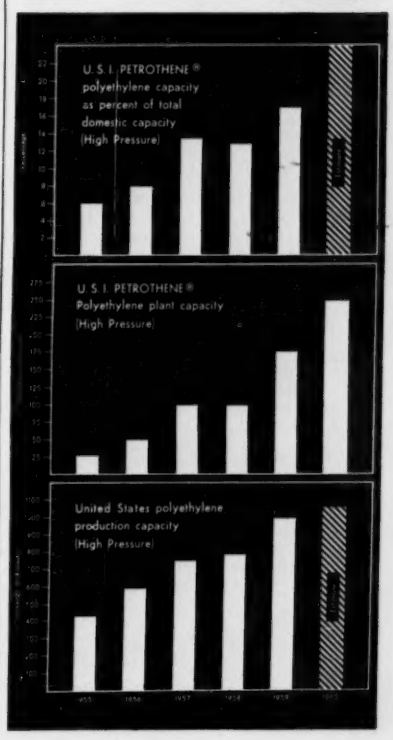
Other suggested fields of applications include metal working compounds, coatings, dry cleaning fluids, hydraulic fluids, biocides and lubricants.

NaK Basis of Prefab High-Temperature Test Loop

A high-temperature test loop, which uses NaK (sodium-potassium alloy) as the circulating medium, is now available as a package unit for research and study purposes.

The loop, designed for 1,000° F, can be employed to examine NaK's natural circulation characteristics, to study oxygen solubility in the alloy, to analyze flowmeter and pump performance, expansion treatment and piping arrangement, to investigate corrosion, mass transfer and metal stress, to design heat exchangers, and to develop pumps.

The unit consists of heaters and coolers, heat exchangers, EM pumps and flowmeters, cold trap, plugging indicators and instruments.


U.S.I. PETROTHENE ® polyethylene capacity as percent of total domestic capacity (High Pressure)
U.S.I. PETROTHENE ® Polyethylene plant capacity (High Pressure)
United States polyethylene production capacity (High Pressure)

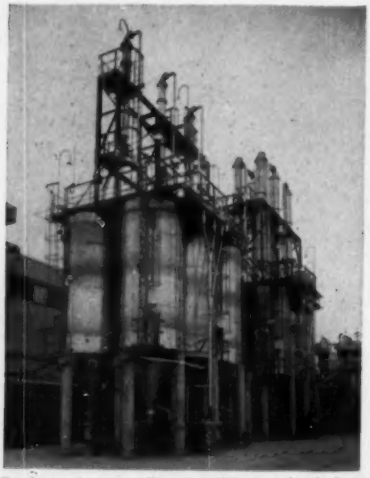
May ★ **U.S.I. CHEMICAL NEWS** ★ 1959

CONTINUED *Polyethylene*

Other Resins Under Consideration

The company is now producing low density (.913 – .924) and medium density (.925 – .929) resins at the Houston unit. However, extensive research work has been done on the new high density polyethylenes and a process has been developed which is believed superior to any now used, both from a product quality and production cost standpoint. The process has not yet been commercialized due to the current market conditions on high density materials. U.S.I. is also studying polypropylenes and other polyolefins in pilot plant, and hopes to have more to say about them later in the year.

In less than four years U.S.I. has advanced from a nonproducer of polyethylene resins to its present position as third largest producer in the field. Commencing with an output of 26 million pounds in 1955, production increased to 50 million in 1956, 100 million in 1957, and now 175 million pounds. When the contemplated expansion at Houston is completed, the company will have realized a total increase in production capacity of some 900% since 1955.

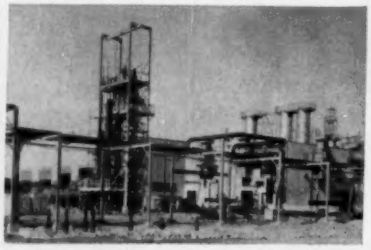


Product storage silos at U.S.I. polyethylene plant, Houston, Texas.

Film Grades a Specialty

Although U.S.I. makes a full line of resins for all applications, much of its growth in polyethylene has been based on special efforts to develop improved coating and film grade resins. Recently the company pioneered a technique for producing crystal-clear cast film. This material has excellent potential in the huge bread wrap field and other large-volume overwrap markets.

Tailor-making resins for specific purposes was originally and still is one of the distinguishing features of U.S.I. as a polyethylene producer. In all, the company markets some 70 resins today, each varying somewhat in melt index, density, strength, clarity, gloss, slip, stiffness and other properties.



Gas-producing area at Houston plant.

Two New Aerosol Formulas Contain Anhydrous Alcohol

Two new formulations – one for a white shoe polish, the other for a stocking-run stopper – have been developed by one chemical manufacturer for consideration by aerosol packagers.

The run-stopping spray consists of equal parts of anhydrous ethanol and a fast-drying adhesive, plus propellant, coloring and perfume. The formula is said to be nonflammable, and is considered stable, although stability tests have not been completed as yet. Recommended filling pressure and method of application are given.

The shoe polish spray – containing an ethanolic solution of PVP/VA, a sebacate, titanium dioxide, glycerine, isopropanol, acetone and propellant – is claimed to eliminate messy handling and to allow easy touch-up. Filling techniques, valve types and pressure are suggested.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Radioactive crystalline C^{14}-L-glutamine can now be obtained for in vivo studies of blood-brain barrier permeability and biological utilization of glutamine by brain and other organs. Specific activity of product is 27.8 μc/mg. **No. 1470**

New carbon-monoxide-poisoning test kit now on market determines extent of CO poisoning in a minute by testing exhaled air or in under five minutes by testing blood sample. Color change in treated silica gel indicates % CO in blood. **No. 1471**

Reactor fuel technology is covered in new, 120-page volume now being sold. Includes papers and discussion on economic fuel selection, blanket fuel systems, types of uranium systems, types of fuel elements, cladding and canning. **No. 1472**

Phosphorus pentasulfide safe-handling practices are described in 14-page safety data booklet which can now be purchased. Discusses hazards, protective equipment, containers, waste disposal, first aid, medical care. **No. 1473**

A circular, slide-rule-type of device, which predicts whether a chemical reaction is possible for 10,000 different chemical equations, is now available to chemists and chemistry students. Complete use instructions given. **No. 1474**

Refined ethylene of 99.5% minimum active-ingredient content is described in new data sheet now being offered. Data includes specifications, properties, shipping information, uses plus references on use as ripening agent. **No. 1475**

New analyzer, said to determine amounts of over 20 amino acids in a protein hydrolysate in only 22 hours, is described in new brochure. Results claimed consistent within 2-3%. Typical run shown. Specifications given. **No. 1476**

Cold caustic pulping of mixed hardwoods is detailed in technical report now offered. Includes complete process description, equipment data, flow sheet, quality control tests. Discusses results of studies on pulping variables. **No. 1477**

Niobium and its compounds are described in new book now being sold. Chapters cover sources, supply, economics, extraction, separation, metal preparation, impurities, properties, plating, alloys, reactions, nuclear uses. **No. 1478**

Over 125 radioactive measuring instruments are listed in new 76-page catalog. Detecting, counting and recording instruments are described. Included are systems for research, medicine and education. **No. 1479**

PRODUCTS OF U.S.I.

POLYETHYLENE RESINS

PETROTHENE® is the registered trademark for U.S.I.'s polyethylene resins. PETROTHENE resins are used in a wide variety of end uses such as film extrusion, pipe extrusion, extrusion coating, wire and cable coating, calendering, injection molding, blow molding, thermoforming and compression molding.

OTHER PRODUCTS

Heavy Chemicals: Anhydrous Ammonia, Ammonium Nitrate, Nitric Acid, Nitrogen Fertilizer Solutions, Phosphatic Fertilizer Solution, Sulfuric Acid, Caustic Soda, Chlorine, Metallic Sodium, Sodium Peroxide, Sodium Sulfite, Sodium Sulfate.

Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Urethan USP, Riboflavin USP, Intermediates.

Alcohols: Ethyl (pure and all specially denatured formulas); Anhydrous and Regular Proprietary Dentured Alcohol Solvents SOLOX®, FILMEX®, ANSOL® M, ANSOL PR.

Organic Solvents and Intermediates: Normal Butyl Alcohol, Amyl Alcohol, Fusel Oil, Ethyl Acetate, Normal Butyl Acetate, Diethyl Carbonate, DIATOL®, Diethyl Oxalate, Ethyl Ether, Acetone, Acetoacetanilide, Acetoacet-Ortho-Chloranilide, Acetoacet-Ortho-Toluidide, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Sodium Oxalacetate, Sodium Ethylate, ISOSEBACIC® Acid, Sebacic Acid, Urethan U.S.P. (Ethyl Carbamate), Riboflavin U.S.P.

Animal Feed Products: Antibiotic Feed Supplements, BHT Products (Antioxidant), Calcium Pantothenate, Choline Chloride, CURBAY B-G®, Special Liquid CURBAY, VACATONE®, Menadione (Vitamin K_3), DL-Methionine, MOREA® Premix, Niacin USP, Riboflavin Products, Special Mixes, U.S.I. Permadry, Vitamin B_{12} Feed Supplements, Vitamin D_3, Vitamin E Products, Vitamin E and BHT Products.

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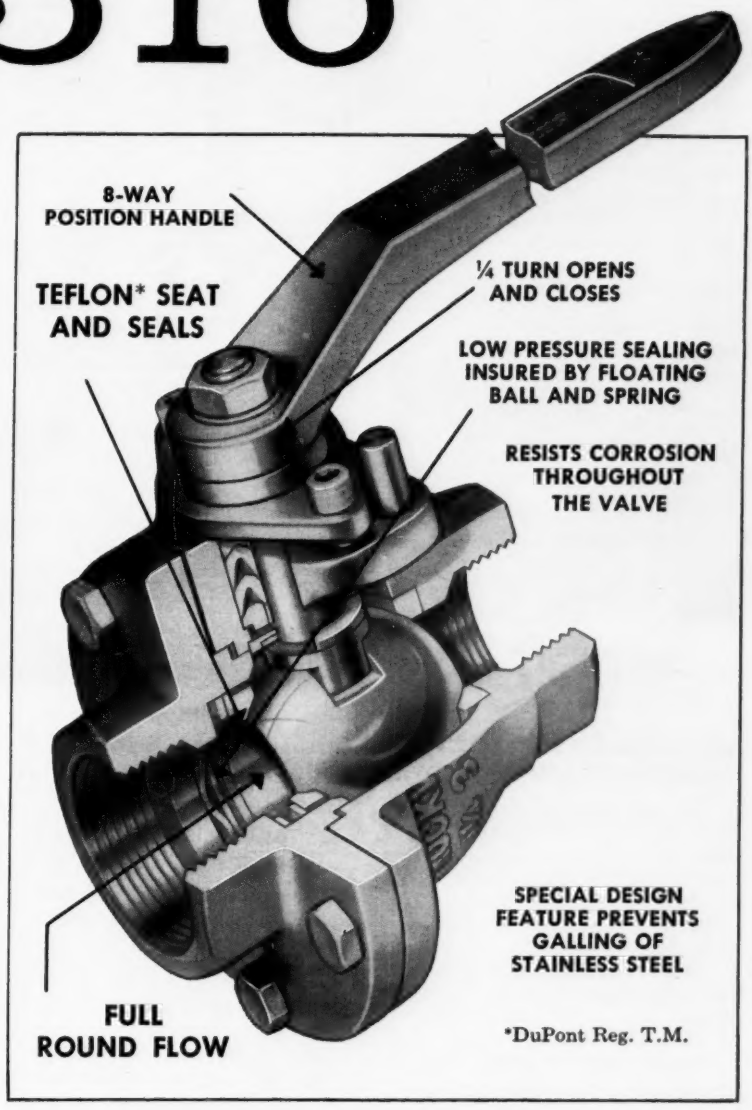
Now you can get the famous advantages of ROCKWOOD Ball Valves—*IN STAINLESS STEEL*—

the "316"

Rockwood's new "316" Ball Valve gives you positive sealing over a wide range of pressures. A simple design utilizing a Teflon ball seat and spring assures you of low pressure sealing (spring behind ball forces ball against the seat) and high pressure sealing (pressure supplements spring for pressure-tight seal). Friction loss and turbulence are also greatly reduced because of the "316's" straight full round flow passage. Features like these have made Rockwood the most dependable name in Ball Valves.

The new Rockwood "316" comes with various types of seats, remote air-operation of wanted sizes, ⅜″ through 2″ screwed ends, 3″, 4″, 6″ and 8″ flanged ends. 600 W.O.G. minus 100°F to 400°F. And it's just one of a complete line of Rockwood Valves and Unions.

Write for Rockwood's new catalog — the inside story of Rockwood Ball Valves is worth knowing. Tested and listed by Underwriters' Laboratories, Inc. Distributors in all principal industrial areas.


8-WAY POSITION HANDLE
TEFLON* SEAT AND SEALS
¼ TURN OPENS AND CLOSES
LOW PRESSURE SEALING INSURED BY FLOATING BALL AND SPRING
RESISTS CORROSION THROUGHOUT THE VALVE
SPECIAL DESIGN FEATURE PREVENTS GALLING OF STAINLESS STEEL
FULL ROUND FLOW

*DuPont Reg. T.M.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

ROCKWOOD SPRINKLER COMPANY
1071 Harlow Street, Worcester 5, Massachusetts

Send me your new Rockwood Full-Flow Ball Valves Catalog No. 57.

Name.....*Title*.....

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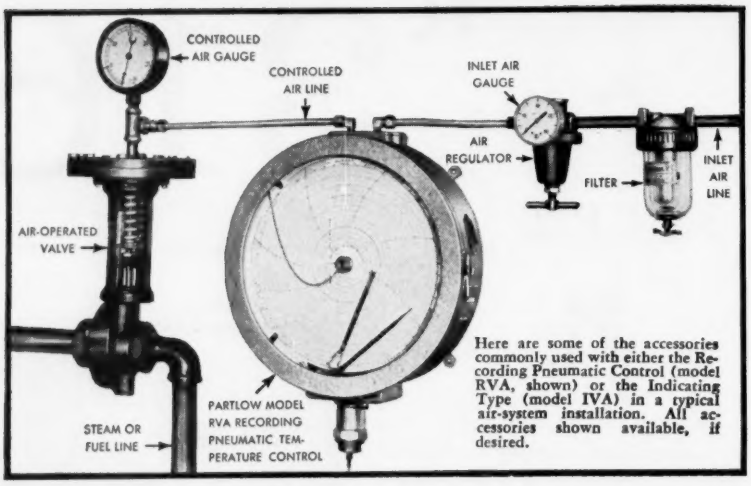
City.....*Zone*...*State*.....

Introducing . . .

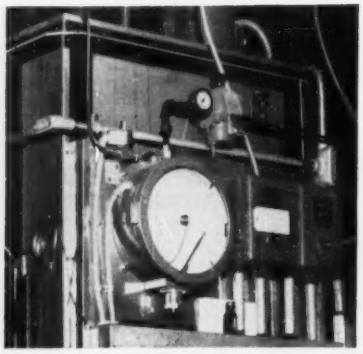
the NEW Partlow Pneumatic Control

New from Partlow . . . throttling-type pneumatic controls engineered to function with extreme accuracy, and sensitivity, under virtually *any* operating conditions.

Actuated as they are by the powerful, direct action of mercury, the Partlow pneumatics actually contain *fewer parts than any other pneumatic control on the market* . . . one reason why they're . . . . **Simpler to install • Simpler to maintain • Simpler to operate • Simpler to replace • and longer lasting, too.**

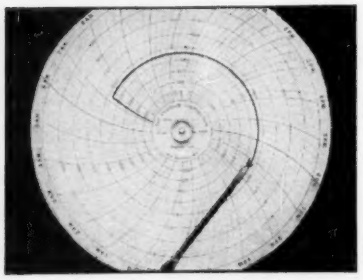


Here are some of the accessories commonly used with either the Recording Pneumatic Control (model RVA, shown) or the Indicating Type (model IVA) in a typical air-system installation. All accessories shown available, if desired.



MODEL RVA

Pneumatic Recording control, installed on new steam-heated cross-flow dryer built by Lydon Bros., Hackensack, N. J.



INSTANT RESPONSE

to temperature changes is a key feature of the Partlow pneumatic. Built-in bulb sensitivity teamed with advanced mechanism design means a minimum of saw-toothing on start-up and a fine line of control when the instrument has reached its throttling equilibrium.

OUTSTANDING FOR ACCURACY, SENSITIVITY AND FLEXIBILITY

The new Partlow pneumatic controls are accurate to within 1% of scale in any one of 10 ranges from –30° to 1100°F. *Exceptionally sensitive too* . . . providing positive, hair-trigger response even to fractional changes in temperature. *And flexible* . . . with throttling range adjustable anywhere from 3 to 20% of scale range.

COST LESS TO OWN AND OPERATE . . CUT "DOWN TIME" TO A MINIMUM!

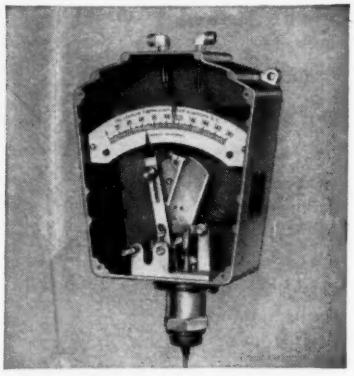
Because they contain fewer parts, Partlow pneumatic controls cost less to buy: next to nothing to operate and maintain. *All elements of the same range are interchangeable*, which means they can be replaced right on the job instead of back in the factory . . .'Down time' is reduced to a matter of minutes. And no expensive inventory of spare parts or spare instruments is ever required.

IDEAL FOR HAZARDOUS OR 'SHOCK' LOCATIONS!

There are no delicate electronic tubes or gadgets in the Partlow pneumatic to get out of kilter, or possibly trigger an explosion. Its ruggedly simple internal mechanism is virtually shock-and vibration-proof . . provides maximum resistance to moisture, fumes, acid and all types of corrosion. Long-life and trouble-free performance are hallmarks of the pneumatics, as they are of all Partlow controls.

EXCEPTIONALLY VERSATILE TOO!

Both pneumatics — the Recording and the Indicating models — can be used in systems regulating the flow of steam, water or gas . . . or controlling other air-operated devices. Whatever the nature of the heating appliance it actuates, the chances are there's a Partlow pneumatic control to fit your requirements dependably . . . economically . . . *precisely*.



MODEL IVA (interior view)

New Partlow Pneumatic Indicating Control, with throttling range adjustable from 3 to 20%.

SEND US YOUR SPECIFICATIONS

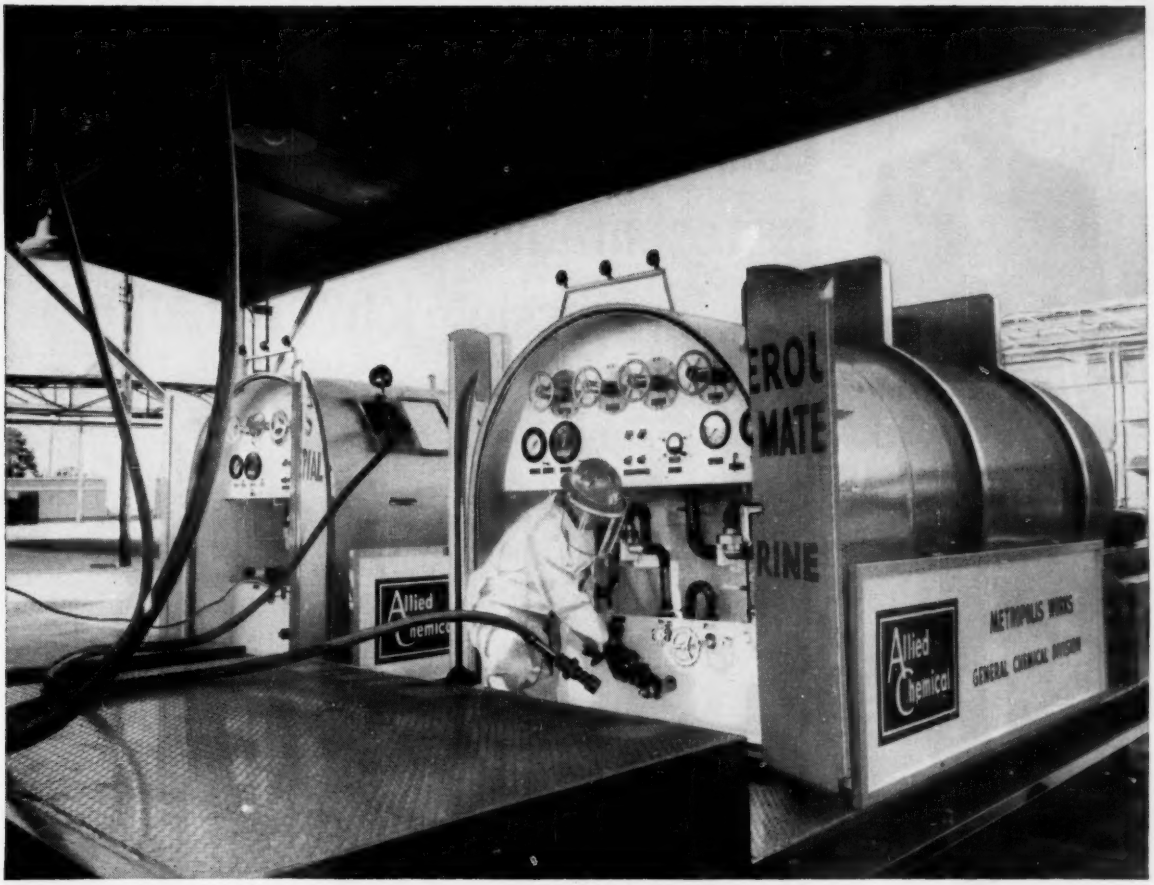
Ask today for a control recommendation tailored for your specific requirements. Of course, if desired, you may field-test this superb new control without cost or obligation. For details write, wire or phone Dept. E-559.

The Partlow Corp., New Hartford, N. Y.
EXPORT ADDRESS: AURIEMA, INC., 85 BROAD ST., NEW YORK 4, N. Y.

You can pay more but you can't buy better than

PARTLOW

TEMPERATURE CONTROLS



New trailer delivers 2½ tons of liquid fluorine

Corrosive chemical travels safely, stays pure, in Monel*

Commercially pure liquid fluorine in bulk is now being shipped thousands of miles. It goes in 2½-ton capacity truck-trailers like those shown above.

The trailers are equipped to cool the fluorine below its boiling point with liquid nitrogen. Units are said to be so efficient that fluorine will remain liquid several weeks even in searing desert weather. Bulk fluorine shipment and the equipment to accomplish it are developments of General Chemical Division, Allied Chemical Corporation.

Inertness of Monel to fluorine safeguards shipments and quality

The inner "business" tank in the trailer is Monel* nickel-copper alloy. The enclosing nitrogen tank is Nickel-containing stainless steel.

Both Monel alloy and the Nickel-containing stainless steel retain excellent ductility and strength well below the sub-zero temperatures of liquid nitrogen. They're well able to withstand unexpected pressures and the shocks of travel.

In tanks made of these alloys the fluorine proceeds tranquilly to its destination. There it can be stored in the same tanks until used.

Monel alloy is also highly resistant to corrosion and to ignition in fluorine at high temperatures since it forms a protective adherent fluoride film. Shipment remains free of contaminating corrosion products.

Protect *your* fluorine processing and handling equipment with Inco Nickel Alloys. A new Inco fluorine booklet, "Handling Fluorine and Fluorine Compounds," goes into detail on fluorine corrosion, suggests means of overcoming it. If you like, we'll send you a copy.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street — New York 5, N. Y.

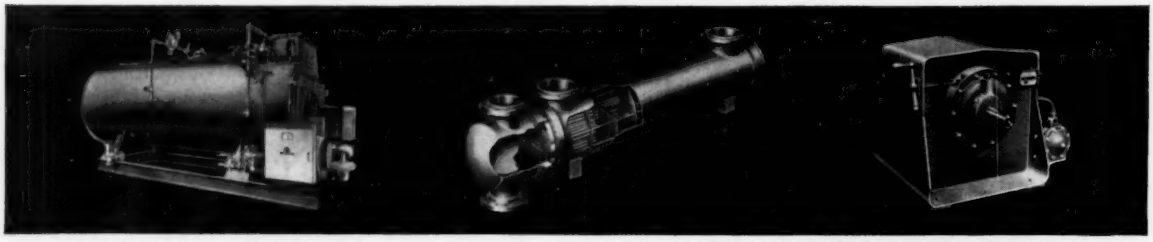
INCO

INCO NICKEL ALLOYS

Calling in equipment representatives on your processing job?

Be sure <u>one</u> of them is from
AMERICAN-Standard
Industrial Division

You benefit by discussing equipment-selection with an engineer. American-Standard* Industrial Division is engineer-staffed from brass to branches. Combining three American-Standard divisions—American Blower, Ross Heat Exchanger, Kewanee Boiler – this new organization offers *one-source responsibility* for quality and performance in equipment designed, engineered, and manufactured to work together. There are offices in all principal cities; contact the one nearest you. American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario.



Firebox, scotch-type steel boilers and package units for heat, power, steam.

Heat exchangers, condensers, and feed-water heaters for every requirement.

Fluid drives for stepless, adjustable-speed control of driven machinery.

*AMERICAN-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

Left: Designed to operate under 300 psig. at 450°F, this vessel will be subjected to unusually corrosive service. Hastelloy, a non-ferrous nickel-base alloy, was specified to line the vessel. The ASME Code shell was first lined with narrow strips and segments by manual metallic arc welding. The welds were then covered by cap strips, heliarc welded to the liner. Multiple tests confirmed the excellence of the welds.

Below: Graver's skills in forming and lining vessels to conform to efficient operating requirements is demonstrated by the head for the vessel at the left. Not only must the fit be exact but all welding of the Hastelloy lining must be tight in order to protect the vessel against corrosion and the product against contamination.

Need This Protection Against Corrosion?

Hastelloy is one of the most effective metals to use in vessels requiring maximum protection against corrosion. But at the same time, it calls for precision welding. The cost of Hastelloy usually suggests use as a lining material, which puts a premium on welding skills. Graver has developed an expertness in welding Hastelloy not commonly available elsewhere. The advanced fabricating techniques used are the result of Graver's continuous welding research program. Graver's competence with Hastelloy is one of a number of reasons why it pays to call on Graver for fabrication of all types of alloys.

GRAVER TANK & MFG. CO.
DIVISION—UNION TANK CAR COMPANY
EAST CHICAGO, IND.

GRAVER®

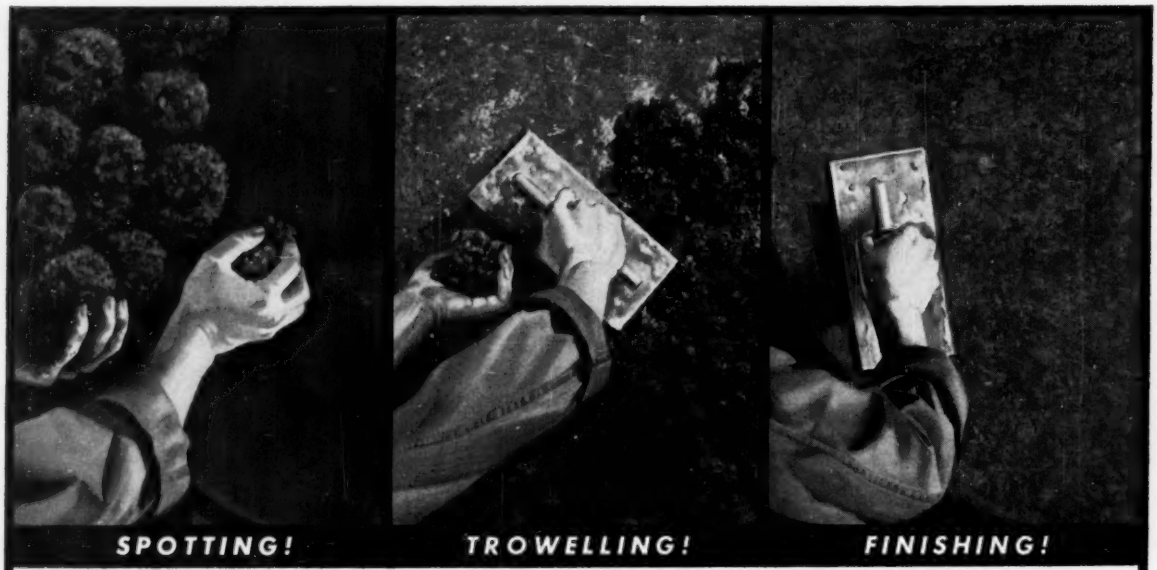
Plants and Offices Across America

IT STICKS TO HOT OR COLD SURFACES!

EAGLE-PICHER

SUPER "66"

INSULATING CEMENT



SPOTTING! TROWELLING! FINISHING!

- Because it sticks, Super "66" saves time—applies quickly to any equipment, cold or hot! Effective up to 1800 F.
- Because it sticks, Super "66" saves money—provides far greater coverage and more efficient insulation.
- Because it sticks, Super "66" makes difficult jobs easy—can be used on irregular shapes where application of other insulations is often impossible. Usually requires no reinforcing on applications up to 1½ inches thick.
- Unique "springy ball" structure of small, resilient mineral wool pellets results in maximum efficiency—maximum fuel savings!
- Super "66" contains a special rust inhibitive which actually prevents corrosion!

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

FREE SAMPLE!

Write today!

Eagle-Picher Super "66" Insulating Cement conforms to Commercial Standard CS-117-49.

Since 1843

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The Eagle-Picher Company • General Offices: Cincinnati 1, Ohio

(Member of Industrial Mineral Fiber Institute)

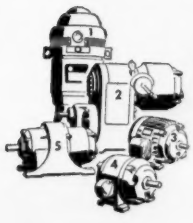
U.S. UNIBASE pump motor

...with exclusive MICROSET coupling

Designed to simplify pump maintenance and minimize down time in industrial short-coupled service, the new U.S. UNIBASE MOTORS make it easy to handle the replacement of pump seals and other recurring maintenance operations. Large side opening gives unhampered access to coupling. Ingenious coupling spacer arrangement eliminates necessity of dismounting motor to replace pump seal. Exclusive U.S. MICROSET COUPLING makes accurate fine adjustment of pump impellers quick and simple without coupling disassembly. Rigid, rugged UNIBASE is *one integral package,* factory tested for true alignment and concentric mounting... and delivered as a unit. UNIBASE MOTORS available in Type HV-1, dripproof, 7½ to 125 H.P.; Type JV-1, Totally-Enclosed; Type EV-1, Explosion-Proof. For short-coupled turbine pump applications, specify: "U.S. UNIBASE MOTORS."

FREE
COLOR BROCHURE

For Full Information, send for Unibase Bulletin No. F-1975



U.S. ELECTRICAL MOTORS INC.

P.O. BOX 2058
LOS ANGELES 54, CALIFORNIA
OR MILFORD, CONNECTICUT

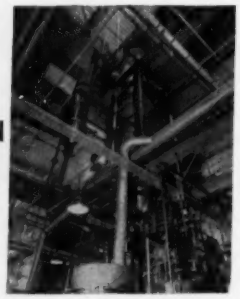
U.S. MAJOR MOTOR LINES INCLUDE:
1. Vertical Solid & Holloshaft, 2. Varidrive, 3. Totally-Enclosed, 4. Uniclosed, 5. Syncrogear. Also, many other special motors.

RODNEY HUNT

FLUID PROCESSING

RODNEY HUNT MACHINE CO., Process Equipment Division, 31 VALE STREET, ORANGE, MASS.

TURBA-FILM INSTALLATION HELPS CUT PRODUCTION TIME IN HALF



With the installation of this Turba-Film Processor, Schering Corporation reported production time cut in half. Schering Corporation was one of the earliest manufacturers to recognize the unique values of the Turba-Film Processor in concentration of a variety of chemical and pharmaceutical products. The installation shown here extends up through three floors at Schering's plant at Union, N. J.

This New Inexpensive Lab Unit Opens Up New Areas In R & D

For the first time you can explore the whole field of mechanically aided high-vacuum processing at relatively low cost. The Rodney Hunt Laboratory Vacu-Film Processor is simple to operate . . . inexpensive to buy. It makes possible the development of data in evaluating the application of high-vacuum techniques to a specific process in a commercial-size unit.

It operates in a vacuum range from atmospheric to 1 micron Hg. at temperatures to 450°C. Continuous feed or batches from 10 ml to 20 litres. Temperature, product flow and rotor speed are easily regulated and controlled. Two or more units may be coupled for fractionation. All parts are readily accessible and can be quickly cleaned like laboratory glassware.

Many Areas of Application

From isolation of essences and removal of odors and color bodies to purification of pharmaceuticals and distillation of fatty acids, the Rodney Hunt Laboratory Vacu-Film Processor uncovers many new applications of great profit potential.

Standard units (illustrated above) are now available for immediate shipment.

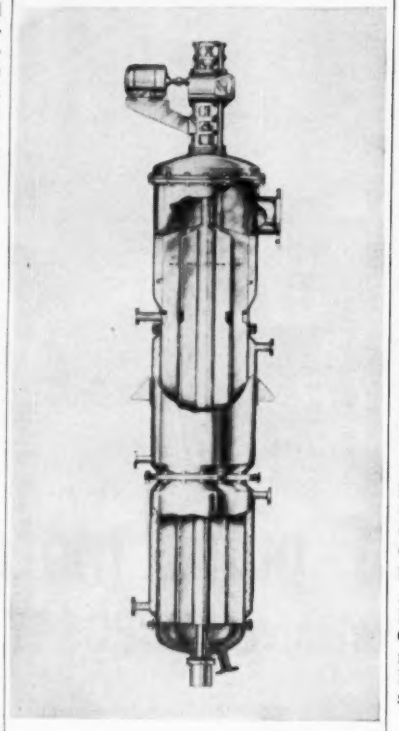
Price FOB Orange, Mass.—$393.00

Descriptive Bulletin PE-108 sent on request.

RODNEY HUNT THIN-FILM TECHNIQUE SOLVES COMPLEX PROCESSING PROBLEMS

Manufacturers of chemicals, foods, pharmaceuticals and many other products have discovered in the Rodney Hunt mechanically aided thin-film processors a simplified solution to complex processing problems. Whether the process involves concentration, dehydration, heat transfer, stripping, deodorization, evaporation or reaction, these units assure closely controlled uniformity of product. They have proved to be particularly effective in processing time-at-temperature-sensitive materials because of short time exposure and minimum hold-up of fluids in the thermal section. The process is completed in one pass, continuously and rapidly, thereby eliminating the problems and downtime of conventional batch processing. Formation of crust or scale is minimized permitting operation for long periods of time without shutdown.

Turba-Film Processor



MECHANICALLY AIDED THERMAL PROCESSING

The Turba-Film Processor consists of a series of rotor blades operating within a thermal section and a separating section—all fabricated of alloy steel. Clearance between the rotor blade edges and the thermal section wall is exactly fixed to assure precise control of the film thickness. Vapor or gases pass upward through the thermal section to the separator from which entrained material is recycled to the thermal section. Steam, Dowtherm or other heating media is distributed in two or more compartments of the thermal section to assure a uniform temperature at the walls.

Broad Operating Range

For processing at atmosphere and low vacuum ranges, Rodney Hunt offers the well known Mark II Turba-Film Processor. The new Vacu-Film Processor is designed for thin-film processing at high vacuum . . . to one-half micron. Installations of this new unit have resulted in higher and purer yields than ever before possible and have greatly simplified the thermal problem associated with high molecular weight materials. It has successfully isolated and purified complex pharmaceuticals which had been impossible to produce by conventional techniques.

Simplify Your Process

Rodney Hunt welcomes your specific requests for assistance in solving the most complex and unusual processing problems. A fully equipped laboratory and pilot plant staffed by experienced process engineers and technicians is available to work with you on your problem. Test results obtained from pilot size Turba-Film and Vacu-Film Processors can be readily extrapolated to production size units. If you prefer to do your own testing, portable units are available for purchase or rental.

Address your inquiry to the Rodney Hunt Process Equipment Division, 31 Vale Street, Orange, Mass. with details of your requirements. Detailed literature on the Turba-Film Processor and Vacu-Film Processor will be sent on request.

* * *

DEVELOPMENTS...

MAY 18, 1959

Chementator

C. H. CHILTON

Nylon-6 tire yarn is being made commercially by Allied Chemical. New yarn is a "singular achievement" in that other nylon-6 makers have been unable to adapt the caprolactam polymer to tire yarn manufacture, says Allied.

Phosphorus atoms built into polyol molecules give flame-retarding properties to urethane foams made from these polyols. New polyols are now available from Virginia-Carolina Chemical Corp.

Polycarbonate resins will be made in Japan by Kunoshima Chemical, following successful pilot-planting last year. Bayer and GE are present producers of this new type of synthetic resin.

Water scrubbing removes acid gases

A novel technique is now being used to remove H_2S and CO_2 from natural gas at the huge Lacq gas field near Pau in southwestern France.

The French are using water scrubbing to remove most of the H_2S, followed by scrubbing with monoethanolamine and a light treatment with caustic soda to remove the rest of the acid gases. Big advantage of water scrubbing is savings in steam, since desorption of the water requires no heating.

These are the operating conditions: Sour gas contains 15.3% H_2S and 9.6% CO_2. Scrubbing with water at 1,000 psi. and atmospheric temperature drops H_2S content to 2% and CO_2 to 8%. Gases dissolved in the water flash off when the water is let down to atmospheric pressure.

About 75 million cu. ft./day of Lacq gas is now being desulfurized this way. Another 110 million cu. ft./day is being desulfurized by diethanolamine scrubbing (plus caustic soda treatment) in units placed on stream in 1957 and 1958. Regeneration of the 20% DEA solution requires heating it to 125 C. Cold desorption of water in the new process is estimated to save 75,000 lb./hr. of steam.

Capacity of the Lacq desulfurization plant will be quadrupled in successive stages by the end of next year. These expansions will employ the new water-scrubbing process.

Further details will be revealed next month at the World Petroleum Congress in New York and will be reported in this magazine.

Curtain falls on trade-secret drama

Denouement of the Monsanto-Central Farmers elemental phosphorus trade-secret case came late last month via a consent decree in Pocatello (Idaho) District Court which neatly compromised a complex situation (*Chementator*, Aug. 25, 1958, p. 51).

Now with 8 important improvements...
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The latest refinement in a long-tested, proved and improved explosion-proof combination Motor Starter & Circuit Breaker, this new Crouse-Hinds Condulet® EPC-M59 brings you tomorrow's convenience, dependability and safety at yesterday's prices.

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2 NEW shoes and guidance slot for easier interior assembly mounting

3 NEW built-in pilot lights available where visual indication desired

4 NEW easier-to-lock breaker handle (takes up to 3 padlocks)

5 NEW center section (and covers) of lightweight aluminum

6 NEW notched covers loosen quickly with pinchbar or screwdriver

7 NEW larger internal space for wiring ease

8 NEW replaceable 3-hole bracket makes mounting quick, easy

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Resident Representatives: Albany Baltimore Reading, Pa. Richmond, Va.

Both parties gained some and yielded some in the legal jockeying. Monsanto's control over its trade secrets is upheld in principle, but the agreement discloses several significant exceptions.

Central Farmers is ordered to forever maintain secret the Monsanto technology it already has knowledge of. Nor may CFFC use any Monsanto trade secrets in its new Georgetown, Idaho, phosphorus plant.

However, the latter restriction does not apply to equipment already built and in place at Georgetown. Furthermore, this restriction expires after ten years, leaving CFFC free to use the disputed know-how thereafter. And the agreement allows CFFC to use any Monsanto know-how which meanwhile legitimately enters the public domain or is acquired "in good faith in an arm's length transaction from disinterested third parties."

Monsanto apparently considers characteristics of power supply to the furnace the cornerstone of its phosphorus trade-secret structure. The court order spells out Monsanto's right to install suitable electrical instruments on Central Farmers' furnace as a policing measure. And CFFC is ordered to disguise the readings of its own voltmeters and ammeters by installing and operating "suitable multipliers."

Monsanto can also inspect CFFC plants for ten years—to make sure that CFFC isn't cheating—but is obliged to keep in confidence any information it picks up thereby.

Each company is bearing its own legal costs in the proceedings. No damages or money payment was provided for in the settlement. Monsanto's complaint against F. C. Torkelson Co. and Charles M. Miller, named defendants along with CFFC in the original suit, was dismissed.

Pigment made by solid-phase reaction

Eagle-Picher has joined National Lead in manufacture of a novel pigment—basic lead silicochromate—for use in anticorrosive paints. National Lead began commercial production at St. Louis last year. Eagle-Picher, operating under National Lead license, recently started up its own facility at Joplin, Mo.

The new orange pigment, which National calls M50 and Eagle-Picher calls Permox 1-4-3, consists of a silica core on the surface of which basic lead chromate has been fused. This product thus provides the desirable pigment properties of basic lead chromate at lower cost and lighter weight.

Manufacturing process was described by National Lead at the American Chemical Society meeting last month in Boston. In the first step, chromic acid solution is added to a water slurry of lead monoxide and finely ground silica containing a small amount of basic lead acetate. The following reaction occurs:

$$2PbO + CrO_3 \longrightarrow PbCrO_4 \cdot PbO$$

The slurry is then transferred to a continuous rotary kiln. Here excess lead monoxide first reacts with the basic lead chromate to form tetrabasic lead chromate, as per this equation:

$$3PbO + PbCrO_4 \cdot PbO \longrightarrow PbCrO_4 \cdot 4PbO$$

Temperature in the kiln is then increased to achieve the following solid-phase reaction on the surface of the silica:

$$4[PbCrO_4 \cdot 4PbO] + 3SiO_2 \longrightarrow 4[PbCrO_4 \cdot PbO] + 3[SiO_2 \cdot 4PbO]$$

Product from the kiln is ground to pigment size and packaged. Microscopic examination after grinding shows that the surface layer is not affected by the grinding step.

Rotation lends process versatility

Jefferson Lake Sulphur's Rotasorber process for wringing liquid hydrocarbons from natural gas streams appears headed for wider exploitation.

National Tank Co., Tulsa, has nailed down an option on exclusive licensing rights and will spend the next six months checking out the Rotasorber's commercial possibilities. To aid in this study, National is building a test unit which will incorporate some of its own know-how in the field of stationary-bed hydrocarbon adsorption units (*Chem. Eng.*, Dec. 15, 1958, pp. 72-74).

The Rotasorber employs a battery of adsorption columns packed with silica gel or activated carbon. The unit rotates in turntable fashion; the various columns are alternately on stream or on purge. One column might extract natural gasoline, another butane and propane.

This arrangement makes it easy to balance length of process cycles and thereby get cleaner cuts and optimum recoveries despite variations in available feed gas and desired product analyses.

(Continued on page 68)

EXCLUSIVE SAVINGS

Future savings in vacuum tumble drying can be previewed at P-K's Vacuum Tumble Dryer Pre-Test Laboratory. Pre-testing realistically points the way to economies in drying time, solvent recovery, process simplification and handling costs. It helps gain management and purchase approval. And it permits modification of controls, condenser, vapor line, receiver and other components to the individual needs of your process and product.

EXCLUSIVE COMBINATION!

Only P-K Vacuum Tumble Dryers offer pre-tested, pre-packaged savings. In pre-testing, results are predicted with a detailed procedure report and test samples. In pre-packaging, a single source of responsibility delivers a tailored, thoroughly proved assembly at a cost far less than a do-it-yourself project.

Compared to tray drying, the advantages of P-K Vacuum Tumble Dryers are overwhelming. Drying is many times faster. Expensive solvents are condensed and recovered. And caking that requires separate pulverizing and screening steps is eliminated. This greatly reduces handling. It often saves enough in labor costs to justify investment. It safeguards against product contamination.

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Chemical and Process Equipment Division

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For several years Jefferson Lake has operated two Rotasorbers in the Bayou Sale gas field, St. Mary Parish, La. During the past year one unit has performed well in recovery of natural gasoline from a lean gas stream. The other unit, which has been used principally for development of LPG recovery, will be converted to gasoline recovery.

Pros and cons of engineering bidding

M. W. Kellogg's recent announcement that it had been awarded a lump-sum contract for a kraft pulp mill focuses attention on a basic issue in the engineering business.

In this particular contract, Kellogg will design and build a 500-ton/day kraft pulp and liner board plant for Tennessee River Pulp & Paper Co. at Counce, Tenn., for approximately $30 million. As Kellogg proudly points out, its acceptance of complete engineering, procurement and construction responsibilities in a single contract, although common practice in the petroleum industry and gaining acceptance in the chemical industry, is not general practice for the pulp and paper industry.

Some engineering societies—notably American Society of Civil Engineers—oppose in principle any such arrangement which encourages the tender or purchase of engineering services on the basis of price competition.

ASCE endorses the traditional setup which splits apart the engineering-design and construction functions. The owner should retain a consulting engineering firm—chosen on the basis of qualifications, not price—to prepare plans and specifications, assist in selection of builder and supervise construction. The construction contract, however, may be awarded on the basis of competitive bidding.

Most old-line engineering firms prefer this way of doing business. But in the chemical engineering field, eagerness of some firms to take on complete design and construction responsibility for a fixed price has forced the more conservative firms, albeit unwillingly, to offer similar services.

Kellogg claims, in its announcement, that "we will be able to deliver a more efficient plant at a lower cost because our engineers will have freedom to design at an optimum capital investment." Whereas the lump-sum contract encourages introduction of new, cost-saving technology, the traditional engineering-consultant approach, opines Kellogg, usually favors established but higher-cost technology.

Thar's UF_6 in them thar vent gases

The strange and wonderful economics of uranium hexafluoride manufacture has justified the development, design and installation of a plant-scale fluid-bed reactor whose sole purpose is to recover "several lb./day" of UF_6 in the vent gases from a —50 F. cold trap.

The new unit, now in operation at AEC's Paducah plant, was described last month at the American Chemical Society meeting in Boston by J. L. Powell of Union Carbide Nuclear Co.

Recovery is based on reaction of the UF_6 content of the vent gas—measured in parts per million—with solid uranium tetrafluoride (green salt) at 400 F. Reaction products, believed to be U_2F_9 and U_4F_{17}, are recycled to the main UF_6 production line (see Process Flowsheet, Mar. 23, 1959, pp. 140-143). Recovery is 99%; payout time is figured at less than two years.

Carbide developed this new "chemical absorption" process because the usual physical methods of gas absorption or condensation would run into terrific problems from reactivity of the fluorine and HF present in the gas.

Get acquainted with this new nylon

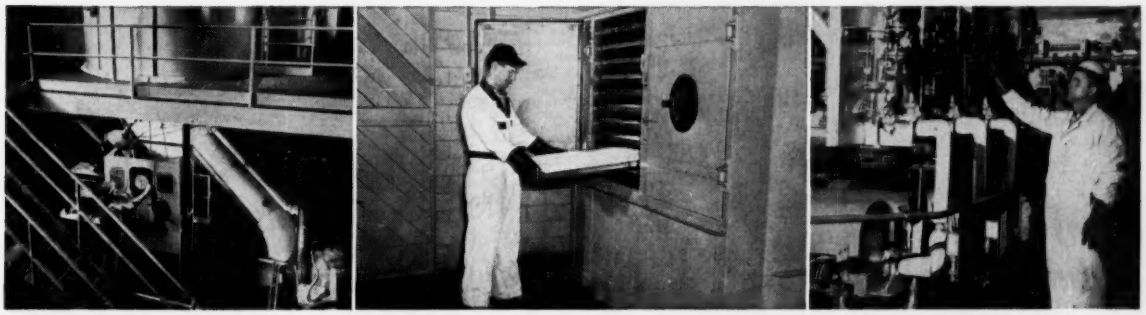
Nylon-11, now being made commercially in France, Italy and Brazil for plastics and fiber uses, gets a boost in the U.S. with appointment of Belding Corticelli Industries, New York, as marketing agent for nylon-11 resins. (BCI already makes nylon-8 under Du Pont license, along with other various compounded nylon resins.)

In its announcement, BCI hints that integrated domestic production of nylon-11 may be in the offing. This would be based on ricinoleic acid derived from castor oil. This 18-carbon chemical is split by a special process into a C-11 compound, undecylenic acid, and a C-7 byproduct, heptanol. The former is converted to 11-amino undecanoic acid, the nylon-11 monomer.

For the past several years Rilsan Corp., Boston, has been quietly building up interest in nylon-11 among potential U.S. customers. Rilsan is owned by Organico, the French nylon-11 producer and a subsidiary of Pechiney. Rilsan's ultimate objective is to establish U.S. manufacture under Pechiney license.

For certain molding applications, nylon-11 resins have properties which, claims BCI,

Made to measure . . . *and made to measure up!*



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give nylon-11 an edge over other nylons. Among these are:

• Dimensional stability, the result of low total moisture absorption.

• Good, permanent electrical characteristics.

• Broad temperature range for forming, which makes possible molding large pieces.

Big potential market for nylon-11, of course, lies in the fiber field. Technology is fairly well established; Organico is producing yarn via a continuous polymerization process.

Major hurdle is development of multimillion-pound markets. This applies to outlets, as well, for the stoichiometric quantities of by-product heptanol or its derivatives, heptaldehyde and heptanoic acid.

Kwh. replace costly oxidizing agent

First commercial production of dialdehyde starch is slated soon by Abbott Laboratories, N. Chicago, Ill.

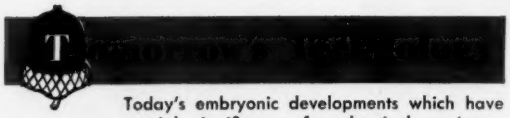
Manufacturing process, licensed from the Dept. of Agriculture, was developed by the Northern Regional Research Laboratory, Peoria. Abbott emphasizes that it will make significant engineering modifications in putting the basic process on a commercial footing.

With large potential in the manufacture of plastics, coatings, binders and adhesives, dialdehyde starch has heretofore been barred from commercial channels by the $25/lb. cost of periodic acid reagent used in its production. In the USDA process, a small initial charge of periodic acid is continuously regenerated and reused.

As described last month by USDA personnel at the Boston ACS meeting, process involves conversion of iodic acid to periodic acid in an electrolytic cell and oxidation of starch with the clear solution of periodic acid in a separate vessel. This two-stage process permits good process control and yields a product of high quality with low lead concentration.

Starch is oxidized with acid at pH 1.0 to 1.5 and temperature of 100 F. for about 3 hr., using 1:1 mole ratio of acid to starch. Total equivalent iodic acid concentration of about 7% and a starch concentration of 5% are used.

Also at work on process scaleup, under USDA contract, is Newark College of Engineering (*Chementator*, July 28, 1958, p. 56). Researchers there expect to have a 2,000-amp. unit in operation next month.



Today's embryonic developments which have special significance for chemical engineers

Research and development briefs

New alkylation catalyst has been reported by American Oil Co.'s Texas City laboratories. A complex of ferric pyrophosphate hydrate with boron trifluoride was found to be particularly effective for ethylene-isobutane alkylation, producing the low-boiling, high-octane (RON = 103) hydrocarbon, di-isopropyl. The new catalyst avoids handling and corrosion problems and short life characteristic of previously available catalysts for ethylene alkylation reactions, say Amoco researchers.

Nitrogen fixation via radiation is objective of Russian research work. Present approach involves blowing a stream of air through a nuclear reactor.

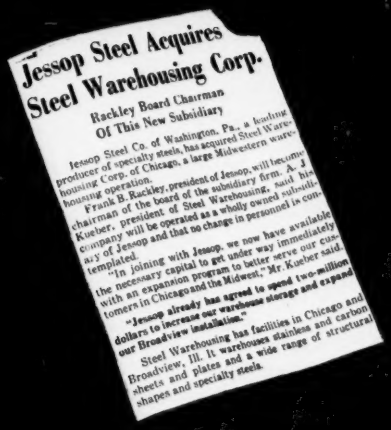
Conversion of oxygen to ozone with an efficiency of nearly 100% is reported by National Bureau of Standards. Laboratory process involves electrical dissociation of oxygen in a microwave discharge near a surface cooled with liquid nitrogen. Method grew out of NBS studies on trapped radicals.

High yield of wood pulp is claimed for a process studied by researchers of the Czech Academy of Science. Boiling of wood in a solution of methanol and hydrochloric acid is reported to yield 80-85 volume percent of a pulp suitable for manufacture of cardboard and coarse wrapping paper.

Optically active silicon compounds have been produced by Pennsylvania State University chemists working under Dow Corning grants. This achievement now provides a powerful tool for studying fundamental reaction mechanics of organosilicon compounds.

Tailor-made dissolving pulps will be possible as the result of new discoveries in fiber structure, according to Buckeye Cellulose Corp. New knowledge revealed by electron microscopy at 5,900 diameters will enable pulp producers to relate their processing techniques more closely to end-use requirements.

For more on DEVELOPMENTS.....72



Jessop Steel Acquires Steel Warehousing Corp.

Rackley Board Chairman Of This New Subsidiary

Jessop Steel Co. of Washington, Pa., a leading producer of specialty steels, has acquired Steel Warehousing Corp. of Chicago, a large Midwestern warehousing operation.

Frank B. Rackley, president of Jessop, will become chairman of the board of the subsidiary firm. A. J. Kneber, president of Steel Warehousing, said his company will be operated as a wholly owned subsidiary of Jessop and that no change in personnel is contemplated.

"In joining with Jessop, we now have available the necessary capital to get under way immediately with an expansion program to better serve our customers in Chicago and the Midwest," Mr. Kneber said.

"Jessop already has agreed to spend two-million dollars to increase our warehouse storage and expand our Broadview installation."

Steel Warehousing has facilities in Chicago and Broadview, Ill. It warehouses stainless and carbon sheets and plates and a wide range of structural shapes and specialty steels.

Jessop buys Steel Warehousing Corporation ...another reason for your confidence!

When you specify Jessop specialty steels, you've got good reasons for that decision. For example . . .

With Jessop, you're dealing with success. Although it's only two years since the acquisition of Green River Steel, Jessop now adds Steel Warehousing of Chicago. Already a two million dollar expansion of warehousing facilities is underway.

This fast growth didn't just happen. It results from the Jessop policy of producing the highest quality specialty steels *and keeping delivery promises!*

Yes, you have good reasons to be confident when you specify Jessop.

VMA 6721

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Washington, Pennsylvania

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New Cooler Levels Bed Temperature

Better heat distribution smooths operation. That's secret behind acceptance of new way to remove heat generated by catalytic reaction.

How to gain better temperature control and increase throughput in high-pressure catalytic converters is outlined in a new patent (U. S. 2,853,371) recently issued to Chemical Construction Corp., New York. Brainchild of Chemico engineer Axel Christensen, the improved converter design is already employed in more than a dozen Chemico ammonia and methanol plants in production or under construction.

One of these installations is the new Escambia Chemical methanol plant at Pensacola, Fla. Escambia's methanol unit came on stream early in 1958, using natural gas as feed material. And backing up the claims for its converter design, Chemico points out that plant started up without a hitch and was delivering product ahead of schedule. Plant is rated at 55,000 gal./day but has produced at substantially over that figure.

Main advantage claimed for the new converter is simplicity of design: Temperature control is simple and positive — and maintenance is easy. As a bonus, conversion is high—around 125 lb./hr./cu. ft. catalyst.

▶**Heat Problem** — Synthetic methanol is produced from carbon monoxide and hydrogen with an over-all reaction:

$$CO + 2\ H_2 \rightleftarrows CH_3OH$$

with the liberation of about 21,700 cal./mole.

Major problem in methanol synthesis is dissipation of this reaction heat to maintain optimum catalyst temperature in order to limit side reactions and to prevent catalyst destruction. With most commercial catalysts maximum conversion occurs at about 710 F.; below 660 F. conversion falls off rapidly while above 800 F. there is danger of catalyst burnup.

▶**And the Answers**—To keep within the temperature limits and still get adequate throughput in the catalyst bed, the designer must provide some method for removing reaction heat.

Other designs besides Chemico's in wide use are the "quench" type and Montecatini converter. The quench converter employs sparge lines to inject cold synthesis gas directly into the catalyst bed. Montecatini design uses pressurized cooling coils embedded in the catalyst to transfer reaction heat to a waste heat boiler.

Commenting on these designs, inventor Christensen points out that with the quench design there are many control valves on the various cold gas lines to worry about and there may be difficulty controlling localized catalyst hot-spots. With the Montecatini design, if anything goes wrong with the external waste-heat system, then the methanol unit must also be shut down.

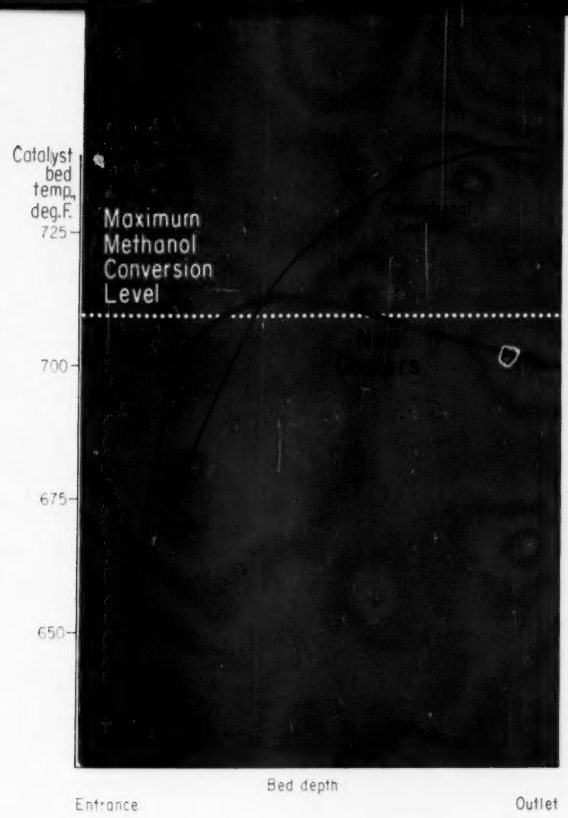
▶**Use Bayonet Tubes**—Chemico's reactor design is based on co-current cooling of the hot reacting gases against the cooler incoming synthesis gas. Synthesis gas coming from the preheater enters bayonet coolers inserted in the catalyst, flows co-currently to reacting gases surrounding the bayonet, then flows back through gas-conducting channels to enter catalyst.

The most recent Chemico patent relates to a modification of the original bayonet design. An extra metal sleeve is fitted over the inner tube in the bayonet so that the trapped layer of gas effectively insulates gas in that portion of the bayonet from heat exchange with the bed. Gases from the inner tube thus emerge relatively cool going into the next pass and absorb more heat from the upper part of the catalyst bed where most of the reaction heat is released.

▶**Slim Profile** — Temperature profile across the catalyst bed is markedly improved by the new bayonet coolers, giving an almost perfectly flat curve. With previous bayonet design, cooling was less effective requiring that more of the reaction heat be absorbed by the gas passing over the catalyst. Since temperature of the gas must be held below 800 F., the amount of sensible heat that the gas could absorb limited the conversion capacity of catalyst.

Flat temperature profile makes temperature control simpler and enables Chemico to get more production per cubic foot of catalyst.

▶**Gas Bypass** — Temperature control in the catalyst bed is provided by a synthesis gas bypass: When temperature climbs too



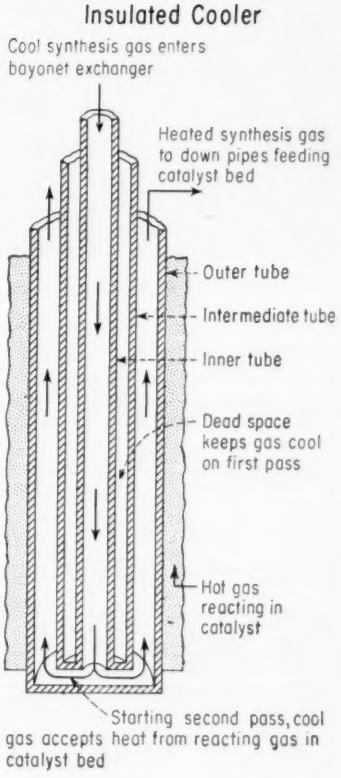
high, cold synthesis gas is mixed with the preheated gas entering the catalyst bed.

Twenty-four rapid-response thermocouples inserted directly in the catalyst record the temperature (thermocouple wells are not used because of the time lag they introduce). A scanner checks each temperature against a preset value. If the temperature at any point is too high, then scanner actuates controls on a motor operating a three-way valve. The valve splits the incoming synthesis gas between the regular synthesis stream (which gets the preheat) and the cold gas bypass.

This system affords positive temperature control: From zero cooling effect to complete cold gas quenching if process upsets.

▶ **Design Data**—Converter at the Escambia methanol plant is 43 ft. long over-all with a 45 in. I.D. Catalyst cartridge holds 158 cu. ft. (as charged) of a standard commercial catalyst.

Synthesis gas stream coming from the steam reformer does not have to be scrubbed free of CO_2 with monoethanolamine as in some processes. Product methanol from the converter is concentrated in a standard Badger Mfg. Co. distillation unit.


Insulated Cooler
Cool synthesis gas enters bayonet exchanger
Heated synthesis gas to down pipes feeding catalyst bed
Outer tube
Intermediate tube
Inner tube
Dead space keeps gas cool on first pass
Hot gas reacting in catalyst
Starting second pass, cool gas accepts heat from reacting gas in catalyst bed

Hydrogen Distillation Isolates Deuterium

France's AEC is building a deuterium production facility that will employ an ultra-low-temperature, hydrogen-distillation process, developed by Sulzer Bros. in Winterthur, Switzerland.

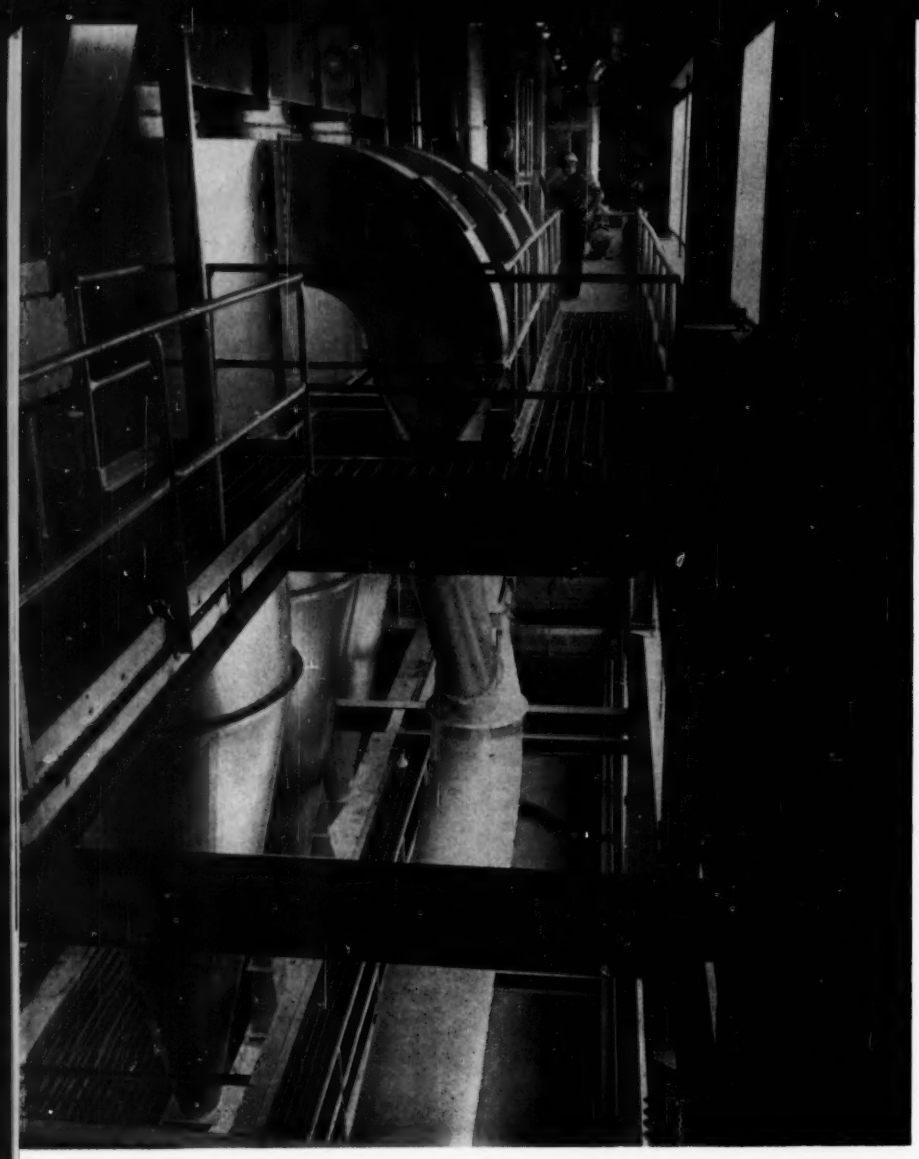
Sulzer's process is the same in principle as one developed by Gesellschaft für Linde's Eismaschinen, A. G., Frankfurt a. M. (*Chem. Eng.*, Feb. 23, pp. 68-71). Process makes use of different boiling temperatures of H_2 (−423 F.), HD (−419 F.) and D_2 (−416 F.). Distillation concentrates HD and D_2 which occur in natural hydrogen.

Sulzer's design centers around a modified version of its own versatile Kuhn-type distillation column (*Chem. Eng.*, Oct. 1956, pp. 246-8). Development work, directed by Prof. Clusius at Zurich University, proved the design feasible and led to modifications of the Kuhn column that improve its low-temperature operation efficiency.

Instead of depending on many wetted-wall tubes for liquid-vapor contacting, the modified column will make use of many packed tubes. Low HD-D_2 content in the hydrogen feed requires the many theoretical plates of the multi-tube design for successful D_2 isolation.

One other modification of the Kuhn column is use of concentric jackets surrounding the column; outer jacket is filled with liquid nitrogen, while the inner one is filled with liquid hydrogen. This technique keeps the column cold and thus prevents heat leaks from the atmosphere to the column.

Pilot model at Zurich University is a single column, said to represent just one of many tubes in the upscaled version being built. France's AEC already uses a multi-wetted-wall version of the Kuhn column to enrich depleted heavy water for reuse.



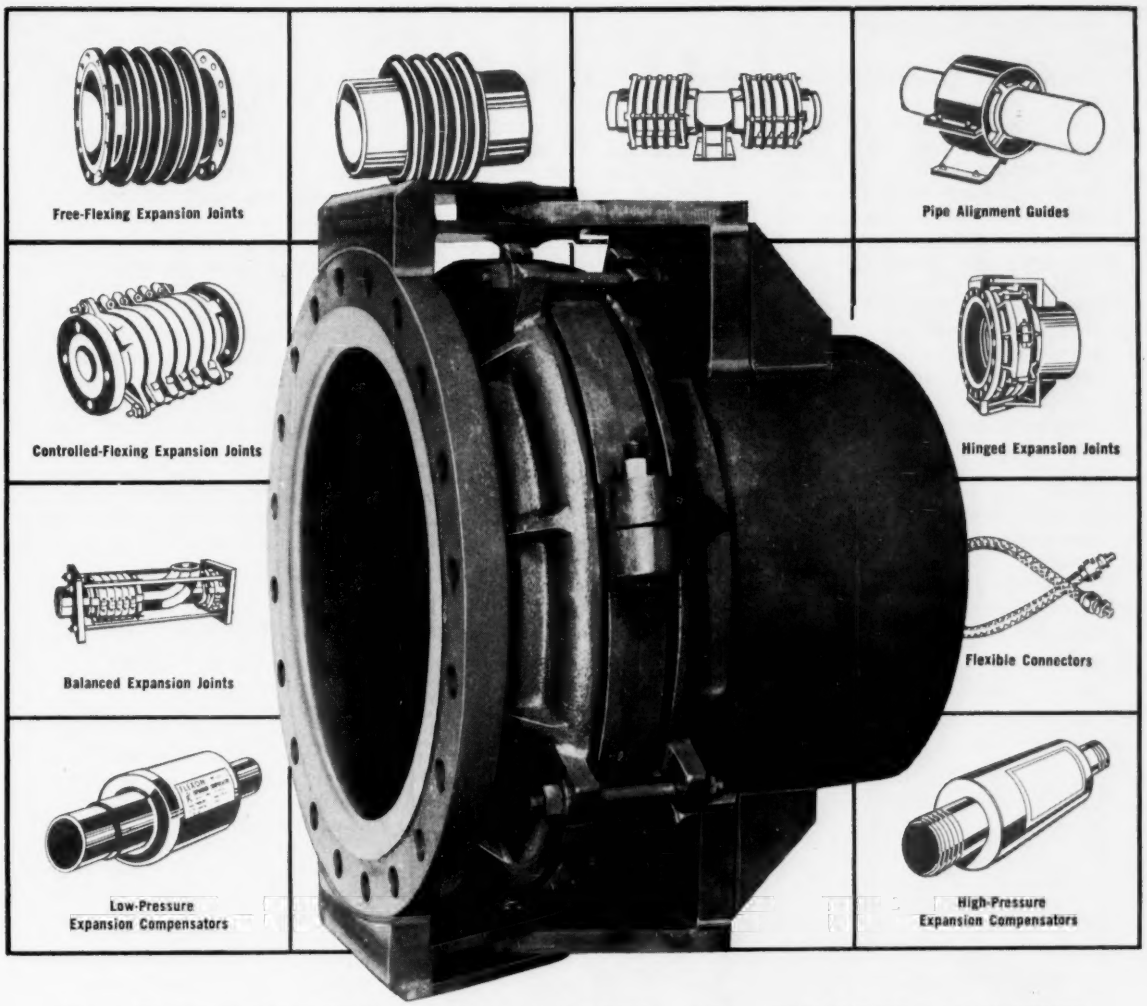
How Processor Converts Dust to Product

In three new plants, fertilizer maker finds answer to yield loss and air pollution by building elaborate air-flow system into process.

Cleanliness is next to godliness, especially when it saves you money. Thus was Canadian Industries, Ltd. motivated, when they built their granulated-fertilizer plants at Chatham, Hamilton and Ingersoll, Ont.

At all three plants, completed during 1958 and early 1959, elaborate dust reclamation systems, integrated with CIL's granulation process, eliminate product loss and exhaust-air pollution of surrounding atmosphere.

At Chatham, dust-bearing air from rotary drying and cooling of granulated fertilizer, first flows through respective banks of cyclones. Each bank consists of three 24-ft.-high, 6-ft.-dia. cyclones, arranged in parallel. Huge 12-ft. wet scrubber fan, driven by a 150-hp. motor, removes entrained solids from 39,000-cu.-



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ft./min., 200-F., cyclone exhaust gas.

At Ingersoll and Hamilton plants, which were built after the Chatham plant, bag filters remove entrained solids from cyclone exhaust. This permits recycle of reclaimed fertilizer dust as a dry solid. Orlon bags withstand the 200-F. exhaust gas.

▶**Integrated With Process**—Dust reclamation system is integrated with process, is housed under the same roof.

Belt conveyor supplies superphosphate and potash raw materials from adjoining mixing building to a constant-weight feeder. Recycle fines from dust-reclamation system and dry premix are thus fed to a rotary ammoniator.

Depending on fertilizer product specifications, sulfuric acid, nitrogen solution or anhydrous ammonia also feed into the ammoniator. Partial granulation takes place in the ammoniator; water, added as required, adjusts the feed's plasticity.

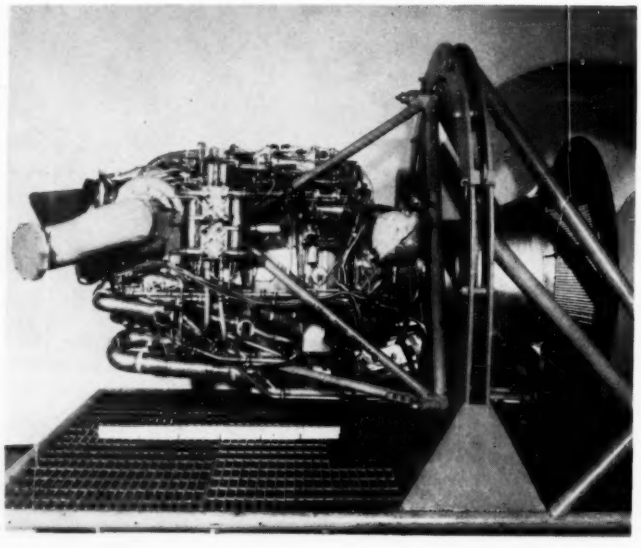
Partially granulated fertilizer discharges from the amoniator, drops down a chute to a granulator, where further rolling action produces round uniform granules.

▶**Drying and Cooling Granules**—Granules drop down a chute to feed a 60-ft.-long, 8-ft.-dia. rotary kiln for drying. Air, heated to 1,400 F., drives moisture from the granules.

At all three plants, furnaces heat the drying air; at Hamilton the furnace is fired with Bunker C, while Ingersoll furnace is gas fired. After a 20-min. residence time, dried granules leave the dryer at 200 F.

Rotary cooler, 60-ft.-long and 8-ft.-dia., cools the dried, granulated fertilizer to ambient temperature prior to storage. Exhaust fans draw cooling air from cooler and heated air from dryer through the dust reclamation system.

Air-swept, double-deck screens separate oversize (greater than ¼-in. dia.) granular and fine fertilizer fractions. Chain mill crushes oversize then recycles it to the screens; fines recycle to ammoniator feed. Granulated fertilizer product is homogeneous, freeflowing, dust free, and will not cake during storage. Because of these handling advantages, granulated fertilizer mixes are widely used here in the U. S. as well as Canada.



Air Force Unveils the X-15's Rocket Power Plant

Designed and built by the Reaction Motors Div. of Thiokol Chemical Corp., this liquid-fueled rocket engine will propel the X-15 more than 100 mi. into space at speeds over 4,000 mph. later this year. Motor develops 50,000 lb. of thrust and is reported capable of generating over 500,000 hp.—making it the most powerful aircraft motor ever built.

Boiling Water Reactor Turbine Stays "Clean"

Much to the relief of reactor designers, buildup of radioactivity in the turbine of a single-loop boiling water reactor is not great enough to constitute a maintenance hazard.

This is the finding of General Electric engineers after more than 3,000 hr. on-stream time logged with the General Electric-Pacific Gas & Electric boiling water reactor at Pleasanton, Calif. Possible concentration of radioactivity had been postulated because steam passing through the turbine comes from water in direct contact with the reactor core.

Engineers also report that the rate of radiolytic decomposition of the water is an inverse function of reactor pressure. Problem of oxygen (from water decomposition) in the steam passing through the turbine and in the recirculating water has not proved troublesome. And they also proved the feasibility of demineralizing returning steam condensate using flow rates greater than 50 gpm./cu. ft. in the resin bed of the water purification system.

Findings were contained in a paper authored by F. J. Brutschy, H. S. Dreyer and W. L. Pearl of General Electric presented at the recent American Chemical Society meeting in Boston.

Tell us your problem

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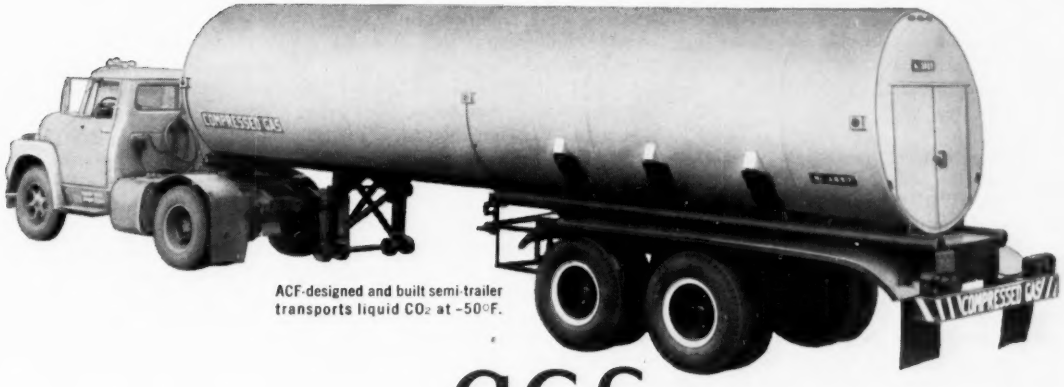

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Oil Exposition to Catalyze Future Gains

Concurrent with technical sessions, exposition at Fifth World Petroleum Congress will show hundreds of new methods and products.

When you come to the Fifth World Petroleum Congress Exposition in New York's Coliseum, June 1-5, 1959, you'll see more than 250 exhibits featuring the latest advances in production and refining technology. Included will be some 20 commercial exhibits from companies in six foreign countries.

Present estimates peg Congress-Exposition attendance at 20,000 level. With foreign preregistrants running ahead of all expectations, you will have ample opportunity to meet engineers from many countries on the Exposition floor.

▶ **Covers Breadth of Industry**—In the Coliseum, you will find exhibits that embrace engineering and contracting facilities, materials and equipment—all aiming at realization of more oil from global resources and more derivatives via refining and chemical processing. Here are a few things you'll see at the Coliseum exhibits:

▶ **For Oil Production**—Importance of production research is reflected in exhibits of refined instruments for the laboratory. And portable instrumentation brings precise laboratory techniques to remote field locations.

Chemical engineers associated with field production problems will be interested in a new sonic pump, shown for the first time after four years of field testing and development. An oscillator, attached to oil-well tubing, generates waves which alternately expand and contract the tubing, lifting liquid up the tube through a series of check valves.

▶ **For Refining** — Instruments, controls and telemetering equipment will be featured in many exhibits. One item of note is a radioisotope instrument that continually measures properties such as specific gravity, percent solids and API gravity of liquids flowing in pipelines.

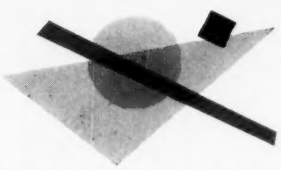
For use with computers in plant control, exhibitors will show an array of stream analyzers. And at least one will show examples of on-line computer systems applied to processing operations.

A manufacturer of trays will show an operating, 2-ft.-dia. perforated tray. Services of a plate-design expert will be available in the booth.

▶ **For Services**—To show use of machine computation, one engineering company will provide a computer equipped with programs for design and revamp of an alkylation unit, design and revamp of gas-recovery system and design of heat exchangers. You can step right up and get a solution to your own problem within minutes.

Still another exhibit will demonstrate model building, isometric drawings and photodrawing.

Among noncommercial exhibits will be booths of technical societies and representatives of foreign countries.



MODERNIZING WITH NEW EQUIPMENT?

what will the REAL cost be?

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INSTALLATION COST
+
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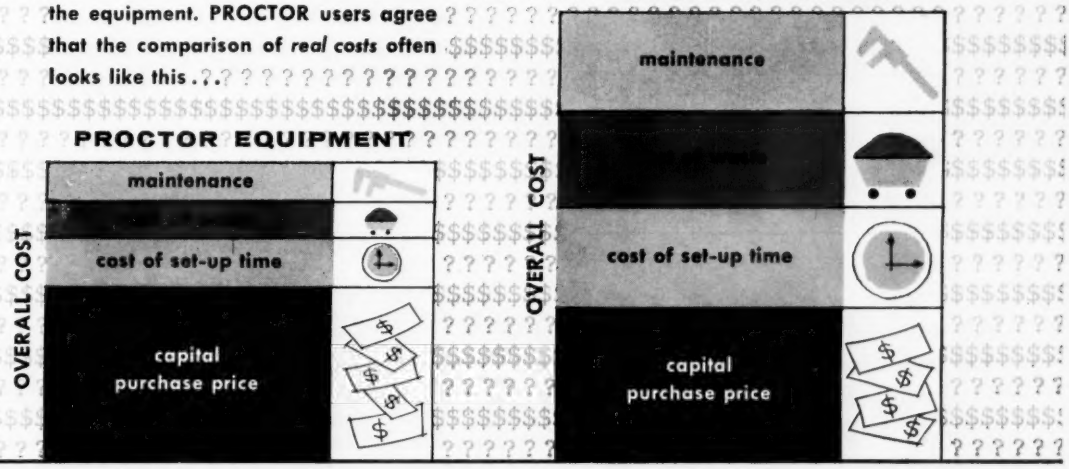
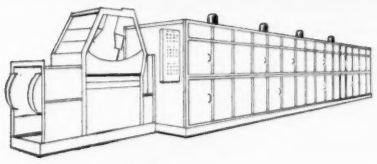
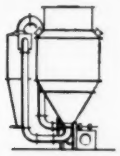




CONVEYOR DRYERS



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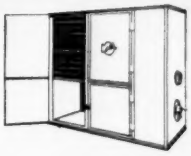

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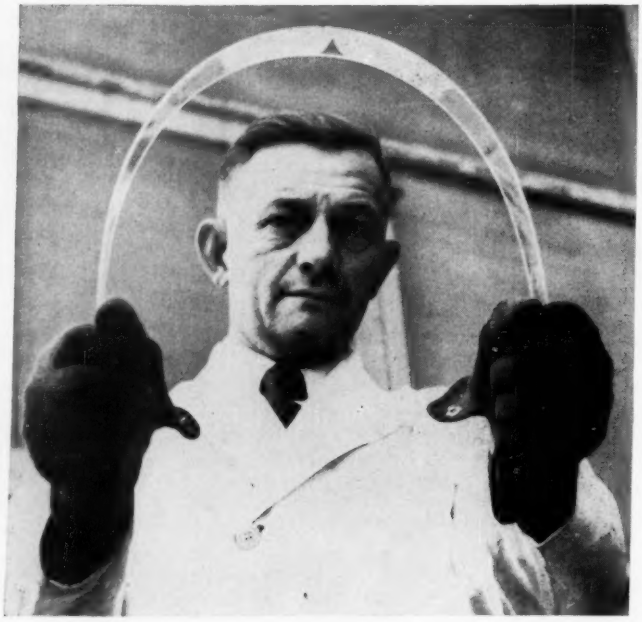


Glass Bends Like Plastic After Surface Treatment

Plate glass treated with HF vapor while immersed in hot acid can be made virtually immune to thermal and mechanical shock while still retaining its transparency, according to Glass-Industry F. van Tetterode, Amsterdam, The Netherlands.

Process eliminates surface irregularities which make glass fragile, enabling it to withstand a temperature difference of 720 F. Libbey-Owens-Ford in this country has taken an option to license the process for possible use in U. S.

Agreements Set Future For Synthetic Penicillins

Agreements signed early in April open the way to commercialization of new synthetic forms of penicillin. Under these agreements, Beecham Group, Ltd., London, and Bristol Laboratories, Syracuse, N. Y., will collaborate in developing synthetic penicillins superior to natural ones now available.

Big advantages promised by new penicillins include greater effectiveness against disease organisms, including those which have become resistant, and a solution to the problem of allergic reactions.

Both parties to the agreements have contributed to synthesis of penicillins.

Bristol supported John C. Sheehan's work at MIT leading to total synthesis of penicillin in 1957 from common raw materials. From this synthesis came production of more than 10 different penicillins, each with a different side chain attached to the basic molecule.

Recently, Dr. Sheehan removed the natural side chain from penicillin-G, the commonest and cheapest natural penicillin.

In Britain, Beecham researchers, headed by F. P. Doyle and G. N. Rolinson, have opened the way to commercial development of the new forms of penicillin. Using an interrupted-fermentation process, they successfully produced the basic nucleus of penicillin at reasonable cost. From this nucleus, they synthesized about 200 new penicillins.

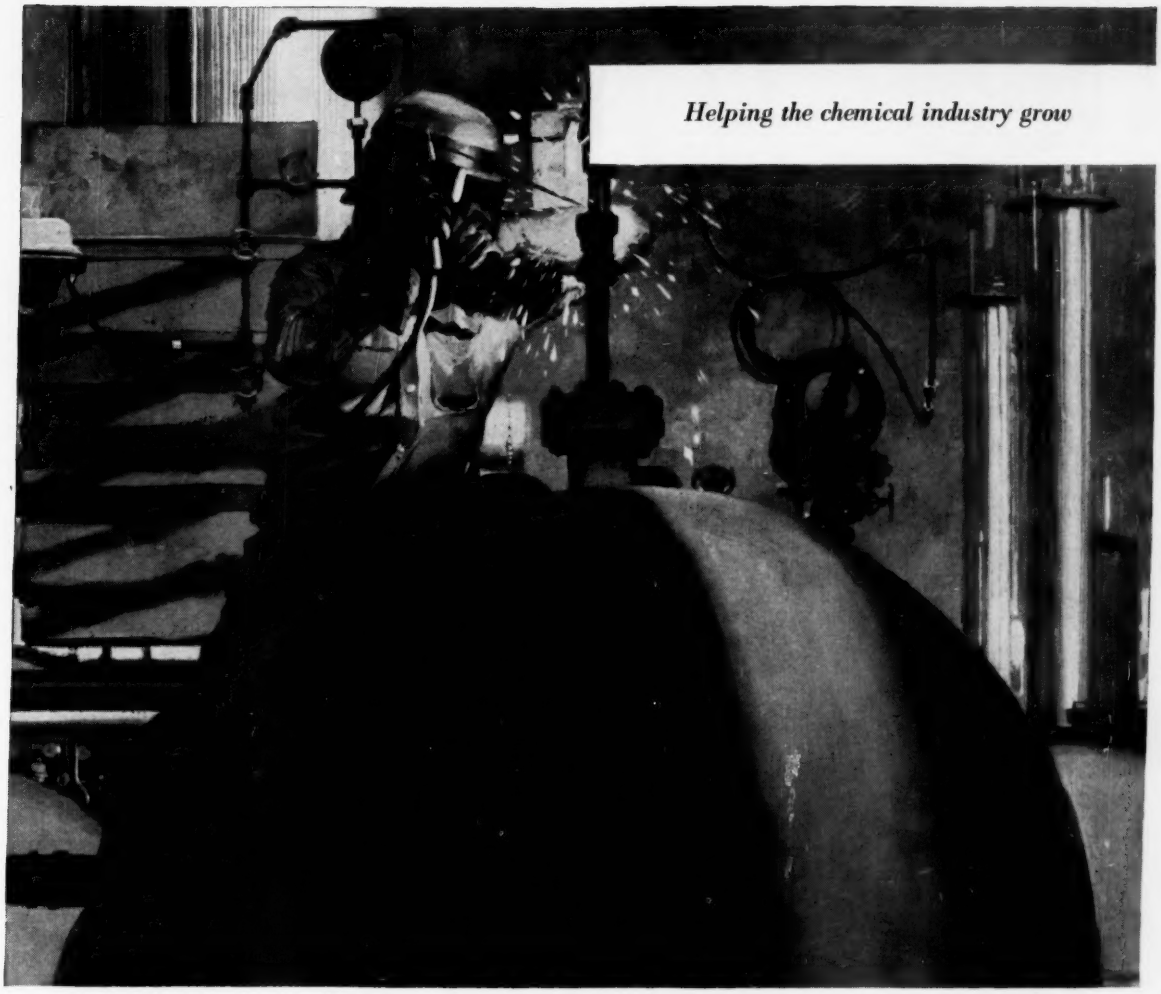
NEWS BRIEFS

Liquefied methane: The "Meane Pioneer," first ship to ply the oceans with liquid natural gas (*Chem. Eng.*, Apr. 6, 1959, p. 72), has completed the return leg of its round-trip run to England. Ship docked at Lake Charles, La., after returning with 1,400 bbl. of liquid methane still in her hold for further testing of the specially insulated aluminum tanks and auxiliary equipment.

Argon: Argon gas containing large amounts of impurities can be cleaned "easily and inexpensively" in an electric furnace according to reports of a Hungarian process carried in the Budapest paper "Nepszabadsag." Gas passes over heated copper shavings, sodium carbonate solution, heated titanium shavings and then phosphorus pentoxide. Resulting argon is 99.7% pure.

Refinery: Foster Wheeler recently landed the engineering contract for the $50-million, 65,000-bbl./day refinery to be built in Mersin, Turkey. Plant is scheduled to go on stream in late 1961. Award was made by Mobil International Oil Co. acting as agent for Anadolu M. Tasfiyehanesi (ATAS), a Turkish firm that will operate the refinery.

Acrolein chemicals: Shell Development chemists have synthesized glycidaldehyde (epoxypropionaldehyde) — long postulated but never isolated —by the "carefully controlled reaction" of hydrogen peroxide and acrolein. Glycidaldehyde is a colorless, pungent liquid of low viscosity and loses only a small fraction of its epoxide value after several months' storage at room temperature.



Atop a storage tank a helmeted welder makes a connection—and still another giant processing plant will soon join the ranks of America's ever-expanding chemical industry. Painting by Stanley Meltzoff.

The Economy of Experience

Operating within established budget limits in the design and construction of a processing plant, large or small, calls for experience of the highest order. Only this can effect cost and timesaving advantages—and still assure the smooth teamwork needed in design, purchasing, expediting and construction.

Making experience pay dividends to our clients has been demonstrated on a wide variety of chemical production and processing plants for some of the country's largest producers.

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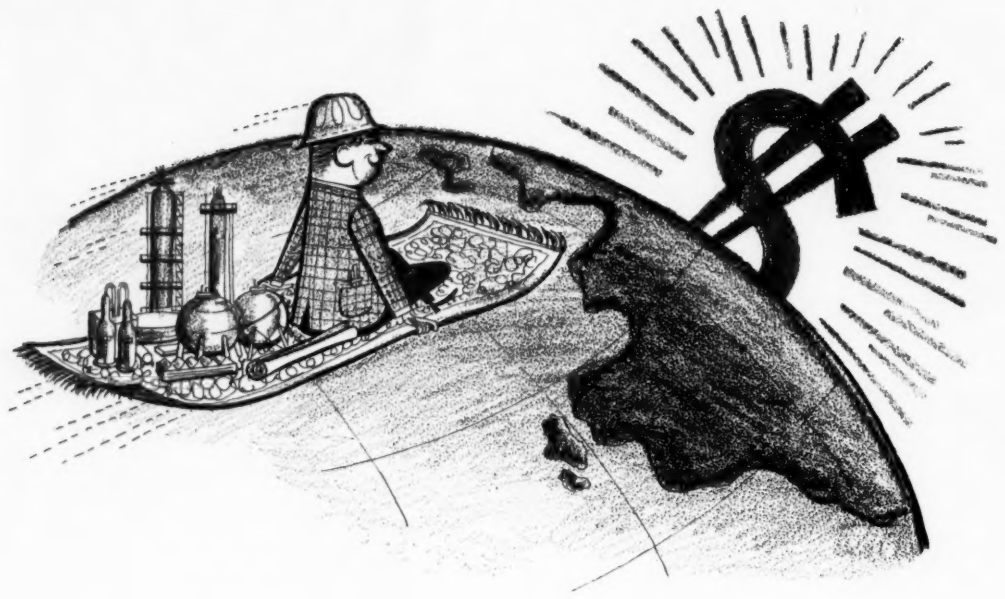

Go Overseas, Chemical Processors

Foreign operation, once a lucrative sideline for a few U. S. chemical companies, is fast becoming an economic necessity for all.

Richard P. Windisch, W. E. Burnet & Co., New York, N. Y.

Most U. S. chemical companies have, until recently, had all they could do to keep up with domestic developments. But a few of them have always made an effort to parallel their domestic activities abroad or to export where chemical manufacturing conditions were economically or politically unfavorable overseas.

Now these and other broad-based chemical companies the world over have particularly good opportunities, if they act quickly, to establish a chain of branch petrochemical, electrochemical and biochemical plants in foreign countries.

▶ **Early Birds**—Among the American companies currently most active in foreign development, Pfizer in biochemicals, and Monsanto in petrochemicals may be said to have an excellent head start.

Union Carbide has been very forehanded in the production and sale of its electrochemical products abroad (batteries, alloys and electrodes), but only recently has undertaken the active exploitation of its tremendous petrochemical knowledge. More of this can be expected.

Reichhold Chemicals, among the small companies, has always followed the policy of building small plants near the market and has a geographical spread of business unequaled by any other American chemical company.

▶ **Hurry Up**—While American Cyanamid, Dow, Du Pont, Hercules, Olin Mathieson and others have recently shown strong interest in foreign expansion, most of them are far behind their European counterparts in going

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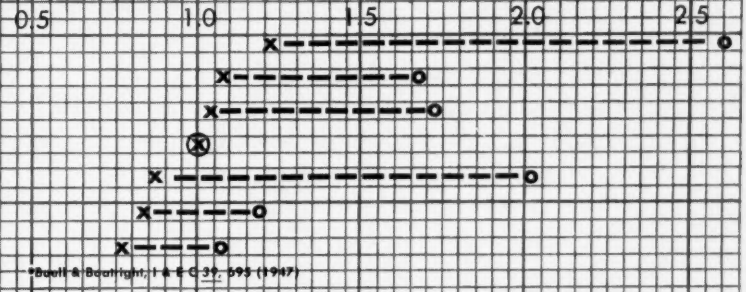

*Buell & Beutright, I & E C 39, 595 (1947)

X = Volatilities of C_4 hydrocarbons relative to 1,3-butadiene; of C_5 hydrocarbons to isoprene

O = Volatilities of C_4 hydrocarbons relative to 1,3-butadiene in furfural plus 4% water; of C_5 hydrocarbons to isoprene in furfural plus 4% water

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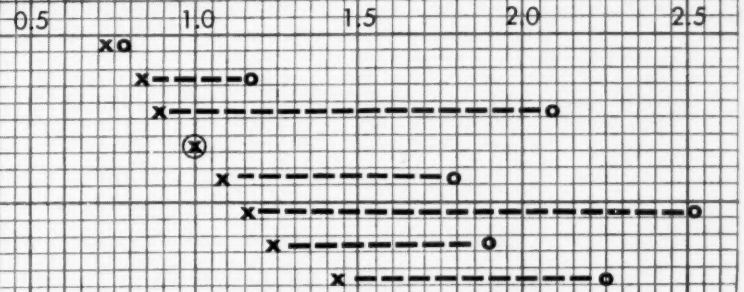

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after the virgin markets for chemicals which are now opening around the world.

Success around the world is available only to the most sophisticated chemical firms, firms with advanced know-how, great experience, plenty of capital, firms which can make themselves locally acceptable.

It is likely, therefore, that the world's great chemical organizations, with their pools of scientific genius and broad experience at home, have the best opportunity abroad by duplicating their home units in those lands which offer venture capital the proper protection.

No other nation can offer as many years of experience in the manufacture of consumer chemical products as can the U. S. Thus, many of our chemical companies should be taking advantage of our government's desire to grant tax advantages on foreign incomes and investments.

How U.S. Firms Stack Up Abroad

Du Pont, subsequent to World War I, cooperated with Imperial Chemical Industries, Ltd., of England to form affiliated companies to supply American-made dyes, fibers, cellophane, and quick-drying paints to the entire Western Hemisphere.

An antitrust suit in 1953 broke up this alliance, and the jointly owned companies were divided into wholly owned subsidiaries of the two parents.

In connection with economic integration plans in Europe, Du Pont subsidiaries have started building a $16-million neoprene plant in Northern Ireland, to be completed in 1960, and a paint plant in Malines, Belgium, to be completed late in 1959.

Plans have been announced to build a 15-million-lb. Orlon plant in Dordrecht, the Netherlands.

In addition, Du Pont has five manufacturing subsidiaries in Latin America and is affiliated with other manufacturing companies in Argentina, Chile and Canada.

Union Carbide, since its early days, has had foreign subsidiaries, particularly in its battery and carbide divisions. It now has 11 battery and flashlight plants throughout the world.

Carbide is also operating calcium carbide plants in Norway, Brazil and the Philippines; graphite electrode plants in England, France, Italy, Sweden and Mexico; alloy plants in England and Norway; chemical plants in England and Australia; and plastic plants in Brazil, England, Scotland and Mexico.

New petrochemical plants in Puerto Rico, Brazil, India, England, Italy and Scotland are or will be completed in 1959.

Early this year Carbide announced another new polyethylene plant to be built jointly with a Belgian company near Antwerp, and a wholly owned polyethylene unit in Australia adjoining a new Mobiloil refinery.

The company's total overseas construction budget amounted to $29 million in 1958. While Carbide carries its foreign investments on its balance sheet at $25 million, equities in these companies exceed this by $95 million.

Monsanto, prior to World War II, seems to have been more interested than other big chemical companies in foreign expansion. As early as 1920 it bought a half interest in an old "fine chemical" company in Ruabon, North Wales, which was making rubber additives, medicinals and flavors —products similar to Monsanto's.

The entire stock of this company was finally exchanged for Monsanto, Ltd., which is listed on the London Stock Exchange, but is two-thirds owned by the American company. This subsidiary now manufactures 80 chemicals, including many petrochemicals.

In 1950, jointly with a British Petroleum subsidiary, Monsanto, Ltd., formed the first chemical company to make styrene monomer in that country.

In 1957 Monsanto purchased 100 acres adjacent to Esso's giant new refinery at Fawley to make acrylonitrile and polyethylene.

Today Monsanto, Ltd., employs 4,100 and in 1957 did a gross volume of about $45 million in its two plants.

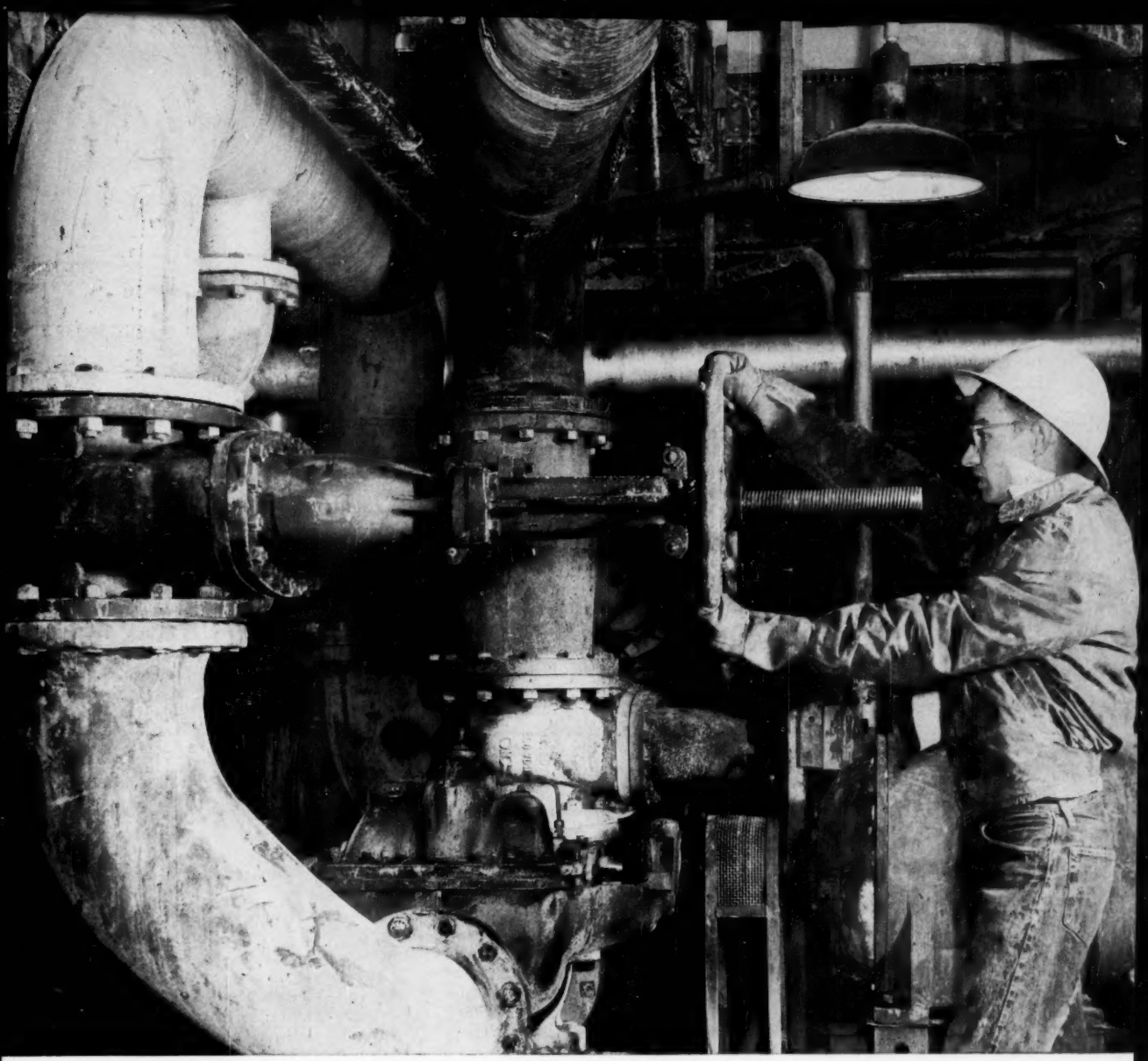
Monsanto was one of the first American chemical companies to recognize the postwar potentialities in Western Europe. As long ago as 1951 it formed a partnership with Societa Edison of Milan, known as Sicedison. Its major activities consist of manufacturing petrochemicals in the Po Valley.

This tidewater location near Venice, close to local petroleum supplies and nearby Middle East-

Some Companies Already Have Big Chemical Stakes Abroad

	Foreign Sales			Foreign Sales	
	Million Dollars	% of Total Sales		Million Dollars	% of Total Sales
Du Pont	161	9	Merck	56	27
Union Carbide	210–280	15–20	American Cyanamid	79[1]	15
Monsanto	172[1]	23	Dow	57[3]	9
Reichhold	55[2]	42	Rohm & Haas	21[3,4]	12
Pfizer	85	39	Olin Mathieson	49[2,4]	8

[1]Not including Canadian sales; [2]Sales of foreign affiliates only; [3]Export sales only; [4]Estimated.



This 4000 gpm Stainless Steel pump has circulated acidic water for four years. It has needed no maintenance.

Stainless Steel equipment cuts replacement costs 75%

AT INTERMOUNTAIN CHEMICAL COMPANY, WESTVACO, WYOMING
operated by WESTVACO CHLOR-ALKALI DIVISION, FOOD MACHINERY & CHEMICAL CORP., NEW YORK

"Hot alkaline crystal slurry ruined our 10,000 gpm pumps after only two years of service," says Mr. Reinert Kvidahl, Operating Superintendent at Intermountain's soda ash plant. "These pumps corroded and leaked. We replaced them with Stainless Steel pumps three years ago, and today they're still in excellent condition. They show no wear at all and no corrosion.

"We also had a 4000 gpm pump that moved acidic water. It needed major repairs in only six months. We replaced it with a Stainless Steel pump that has been in service for four years now and has never needed maintenance.

"Carbon dioxide and other acidic vapors corroded our barometric condensers. We replaced them with Stainless Steel condensers and we've had no more trouble.

"There are many such cases all through this plant. Wherever we had corrosion maintenance problems, we have replaced equipment with Stainless Steel—in pipes, valves, flex joints, filter leaves, linings, even nails and bolts. Because the Stainless resists corrosion and lasts years longer, we've saved more than 75% in replacement costs in spite of the higher initial cost of the Stainless."

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United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

ern oil, has much similarity to our Texas Gulf Coast.* For the manufacture of basic petrochemicals it should be one of the best locations in all Europe.

Affiliated companies in Spain, France, Belgium and Sweden manufacture under Monsanto processes. The company has formed Mitsubishi-Monsanto, Ltd., in Japan to manufacture in the Far East.

Monsanto Argentini SAIC manufactures polystyrene for South America, and is building a phthalic anhydride plant there. Just recently a joint plant has been announced to make polyvinyl chloride in Turkey.

As early as 1940 Monsanto formed a joint subsidiary with a local Australian producer, which is now one of the largest producers of chemicals and plastics on that continent.

Monsanto's half-owned affiliate, Chemstrand, has just opened a $10-million acrylic fiber plant at Coleraine, Northern Ireland, where all materials will be handled on a free trade basis.

Reichhold Chemicals operates subsidiaries in Canada and Mexico and also has stock interest and licensing agreements with affiliates in 23 other countries. All together it has an interest in 25 foreign plants, with five more planned. On its balance sheet the company carries its investment in foreign companies at a figure equal to 30% of its domestic fixed assets.

Reichhold's newest venture is a purchase of 22 acres north of Bordeaux, France, where a new plant is being built to produce special synthetic resins, formaldehyde and pentaerythritol. This plant will be served by a natural gas pipeline from France's new gas field in the Pyrenees. Recently a new plant went on stream in Lisbon, Portugal.

American Cyanamid has a substantial business in mining chemicals, flotation reagents, etc., particularly in South America. It is also making a strong effort to promote its laminated plastic, Formica, in the British Commonwealth and Europe. And, of course, Cyanamid's Lederle division, like other drug companies, sells heavily overseas.

Dow Chemical, while its export sales date back to 1903, showed no real interest in developing them until after World War II. During the last five years they have increased 350% and now represent 9% of sales.

In Mexico the company has a 50% interest in a caustic soda-chlorine plant and a salt dome, and also owns a fluorspar mine. It has formed joint stock companies with local interests to make polystyrene in England, Japan, Australia and India.

Dowell and Dobeckmun, Dow domestic subsidiaries, each have two wholly owned foreign subsidiaries for their specialties.

Besides two wholly owned sales subsidiary offices in 12 countries, Dow owns its own docking and warehouse facilities in Holland.

Hercules Powder, through its strong position in naval stores and their derivatives, has chemicals to sell to the world which are not generally obtainable elsewhere because the U. S. produces the major portion of the world's turpentine and rosin. Hercules' last reported foreign sales were 13%. (Heyden Newport is also in this field.)

Olin Mathieson has acquired stock interests in chemical and pharmaceutical companies in Italy, Belgium, France, Argentina, Mexico, Uganda, Spain and West Germany, including a 25% interest in Chemische Fabrik von Heyden. Olin Mathieson now has affiliated companies, plants or manufacturing licensees in 38 foreign countries, and distribution facilities in many more.

W. R. Grace started in the chemical business during the last century when it imported guano from South America. It now has an enviable position on that continent, particularly in view of its accessory facilities. If it sticks to its basic inheritances and favors its chemical opportunities in South and Central America, Grace could become the world's leader there.

Considering the economies of most of the South American republics and their large consuming centers, the opportunities for chemical expansion are brighter there than in almost any other section of the world. Recent announcements show that the great European chemical leaders are not unaware of this; Brazil is a favorite place for European manufacturing subsidiaries.

Pharmaceutical companies in the U. S., with few exceptions, have always made efforts to sell and manufacture their leading products abroad. It is in this group that we find the highest percentage of foreign sales.

Growth here has been tremendous, due to the advantages our drug manufacturers have enjoyed, such as automated packaging and absence of competition, and, most of all, because of the development of new products through big research spending.

Foreign business is especially important to Parke, Davis, accounting for 32% of its sales; Sterling Drug, 35%; Warner Lambert, 25%; Abbott Laboratories, 24%; and Vick Chemical, 20%. The only two companies included in this report, however, are Pfizer and Merck, because we consider them chemical manufacturers as well as pharmaceutical companies, due to their production of many fine organics.

Pfizer, since the end of World War II, has opened 19 plants abroad mainly to manufacture antibiotics. It now sells its products directly in over 100 countries. With its early recognition of the potentialities for antibiotics in foreign countries, this company has gained the position of our leading international chemical company in having 39% of its sales abroad.

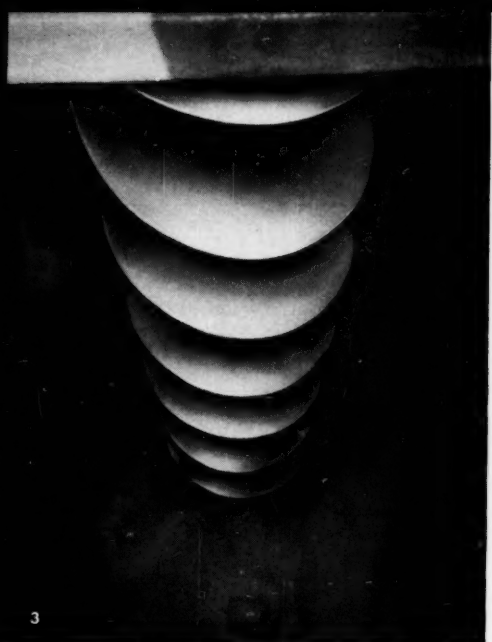
Merck, although an outstanding pioneer in biochemical developments, is handicapped in foreign business due to confusion of its name with that of a prominent Germany company. In 1945, however, it organized a foreign exporting subsidiary which features its Sharpe & Dohme name and is a big factor in DDT which has wide usage in the tropics.

RICHARD P. WINDISCH *has turned a B.S. in chemical engineering administration from M.I.T. into a long and varied career in chemical finance. He has held every possible job in security brokerage from runner to managing partner to consultant for W. E. Burnet & Co.*

(Economics continues, p. 88)

* It's reported that crude oil is available today in Venice at a lower cost than at Houston, Tex.

Improved Processing through Engineered Agitation

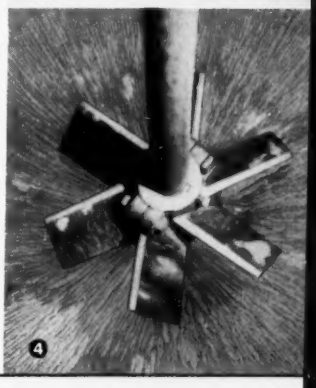


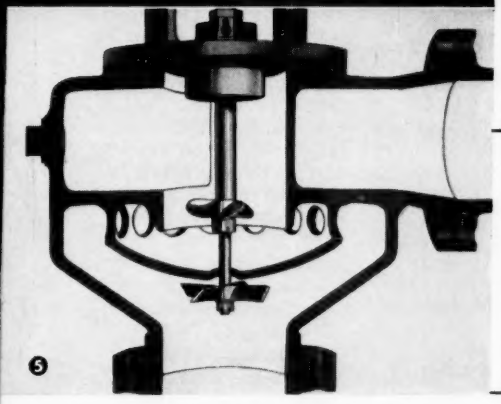
IMPELLER SELECTION . . . THE INSIDE STORY OF GOOD MIXING

THE DESIGN AND PERFORMANCE OF THE IMPELLERS are major factors in the success of process mixers. Determining the right impeller requires a thorough knowledge of below-the-surface action of different impellers in a wide variety of fluids of different density and temperatures.

THROUGH CONTINUOUS RESEARCH AND EXPERIENCE . . . gained in thousands of pilot runs and working installations . . . NETTCO has acquired the impeller know-how so important to efficient mixing. And this below-the-surface know-how can cut your processing costs by minimizing horsepower requirements!

YOUR NETTCO REPRESENTATIVE CAN HELP YOU make your process more efficient . . . more profitable. See Chemical Engineering Catalog or Refinery Catalog for his address or write for Bulletin 581, New England Tank and Tower Co., 87 Tileston St., Everett 49, Mass.



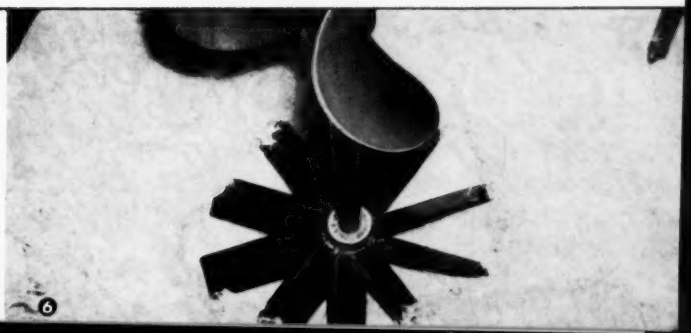


NETTCO

ENGINEERED AGITATION SPECIALISTS

EVERETT 49, MASSACHUSETTS

1. Vertical finger and breaker stirrers used in the dispersion of high viscosity materials.
2. Medium speed propeller recommended for medium size batch mixing of low viscosity material.
3. Corrosion-proof, plastic covered flight impeller which automatically provides variable agitation for variable tank volumes.
4. Split turbine stirrer designed for pressure tanks where minimum tank opening size is necessary.
5. Flomix impellers for continuous pipe line mixing of solids and medium to low viscosity material.
6. Standard turbine and propeller combination provides vigorous agitation for solid suspension, heat transfer and blending.



WATERFRONT ammonia plant of Phillips Pacific Chemical cost $15 million.

Chemical Sites Move Upstream

Improving Northwest river navigability lures chemical processors further and further into the Washington hinterlands.

A new concentration of chemical industry is growing along the Columbia and Lower Snake Rivers in southeast Washington, borne along by steadily developing slack-water navigation facilities. Some $24.6-million worth of chemical plant is now under construction or scheduled to be started this year in the area.

Now being built is the $10-million Boise Cascade pulp and paper mill and container plant near Walla Walla, Wash. California Spray-Chemical is expected to start construction early this year on a $4.6-million plant near Finley, Wash., to produce ammonium nitrate, ammonium nitrate solutions and high-analysis nitric phosphate plant foods.

And Bunker Hill Co. has announced plans to build a $10-million phosphate fertilizer plant this year, possibly near Finley.

▶ **Dam Did It**—Industrial development of the area started in 1953 with the raising of the 60-mi.-long reservoir behind McNary Dam on the Columbia near Umatilla. New multipurpose dams—under construction and authorized—hold the promise of continuing expansion.

While four port districts had been operating on this stretch of the Columbia before McNary Lock opened, uncertainties of the river flow and rapids above Umatilla excluded major tonnage.

Since the raising of the reservoir some $40 million has been invested in production storage and distribution facilities—all directly connected to the water transportation. Shipping volume hit a record 968,000 tons at McNary Lock last year, continuing its steady increase since 1953.

Upstream total included some 130 million gal. of petroleum products and 55,000 tons of various products including bulk cement, hot asphalt, steel, chemicals and farm machinery. Downstream products included 27 million gal. of petroleum products from pipeline heads at Snake River tank farms, and some 5,500 tons of chemicals, fertilizer and processed products.

▶ **Busy Terminal**—One of the largest concentrations of industrial properties in the McNary Reservoir area is a 3-mi. strip along the Snake River east of Pasco. Located here is the Tidewater Terminal, operated by Tidewater-Shaver Barge Lines, Portland. Included at this terminal are waterfront facilities for:

Collier Carbon & Chemical, which maintains tanks and loading facilities for 10,000 bbl. aqua ammonia.

Permanente Cement, which operates bulk tanks and loading facilities for cement.

Shell Oil, which has tanks and loading facilities for hot asphalt shipped by barge from Portland to Pasco and trucked, hot, from the Pasco terminal to delivery points in eastern Washington.

Pennsylvania Salt, with storage and loading facilities for liquid caustic soda.

Shell Chemical, with two large Hortonspheres for storage and distribution of anhydrous ammonia.

About one mile downstream on the Snake from the Tidewater-Shaver site is the East Pasco terminal of Standard Oil (Calif.). The Standard tank farm includes loading facilities for rail and barge. Adjacent to the Standard operation is the Pasco terminal of Salt Lake Pipeline, which operates the line from Salt Lake City to Pasco, and from Pasco to Spokane.

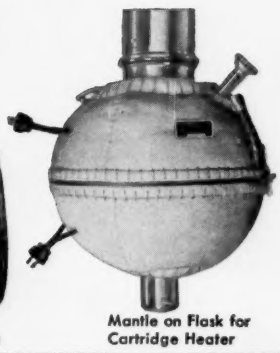
▶ **Fertilizer Center**—Industrial development in the Kennewick Port District, across the river from Pasco, consists largely of chemical and fertilizer facilities which have located at sites along the river between Kennewick and Finley, Wash.

Largest single project in the area is the $15-million Phillips Pacific Chemical anhydrous ammonia plant near Finley, which went into operation in 1956 with a 200-ton/day capacity (see photo this page).

Allied Chemical has maintained a small plant in the Finley area for a number of years to produce nitric acid, liquid alum and ammonium nitrate. This plant has been expanded during the past three years.

Two smaller plants that have been established in the Finley area since 1956 are Gas-Ice Corp., which manufactures liquid carbon dioxide and dry ice, and Kerley Chemical, which makes a fertilizer called "nitro-sul."

Globe Valve & Mantle


Mantle on Flask for Cartridge Heater

Series M Heating Mantle

Heating Top for Two-Neck Flask

Heating Top for Two-Neck Flask with Side Opening

GLAS-COL *makes a complete line of* **HEATING MANTLES**

. . . for chemical process, pilot plant and laboratory heating applications

CO_2 Purged Heating Mantle

Distillation Kettle Mantle

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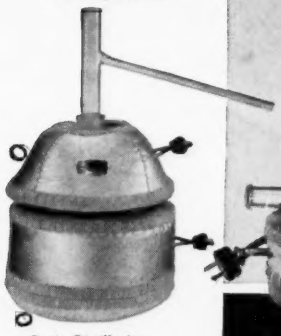
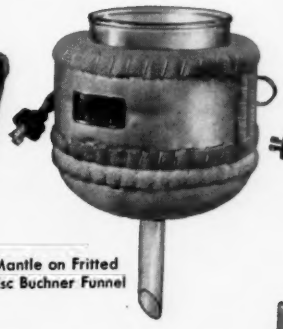
Special Mantle for a Three-Neck Flask

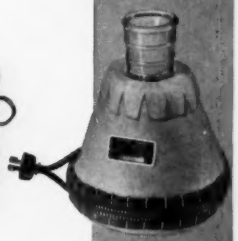
Spherical Mantle for a Two-Neck Flask with Side Opening


Resin Distillation Flask Mantle

Molecular Still Mantle

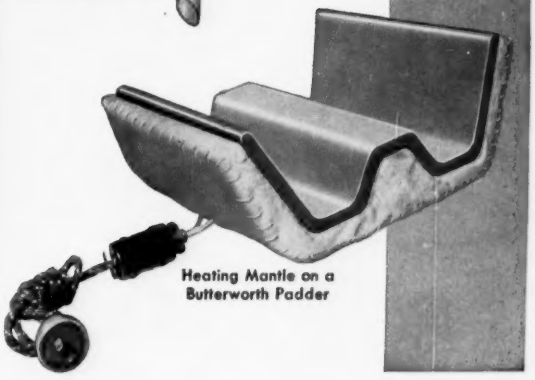
Mantle on Globe-Type Separatory Funnel


Mantle on Fritted Disc Buchner Funnel


Erlenmeyer Flask Mantle

three types:
glass-fabric mantles,
quartz-fabric mantles,
650° C Glas-Col "R" mantles

GLAS-COL
ELECTRIC HEATING MANTLES


Heating Mantle on a Butterworth Padder

Trademark Registered U. S. Patent Office
U. S. Patents — 2,282,078; 2,231,506; 2,739,220; 2,739,221

Specialists in Laboratory and Pilot Plant Heating Problems

GLAS-COL APPARATUS COMPANY, INC.
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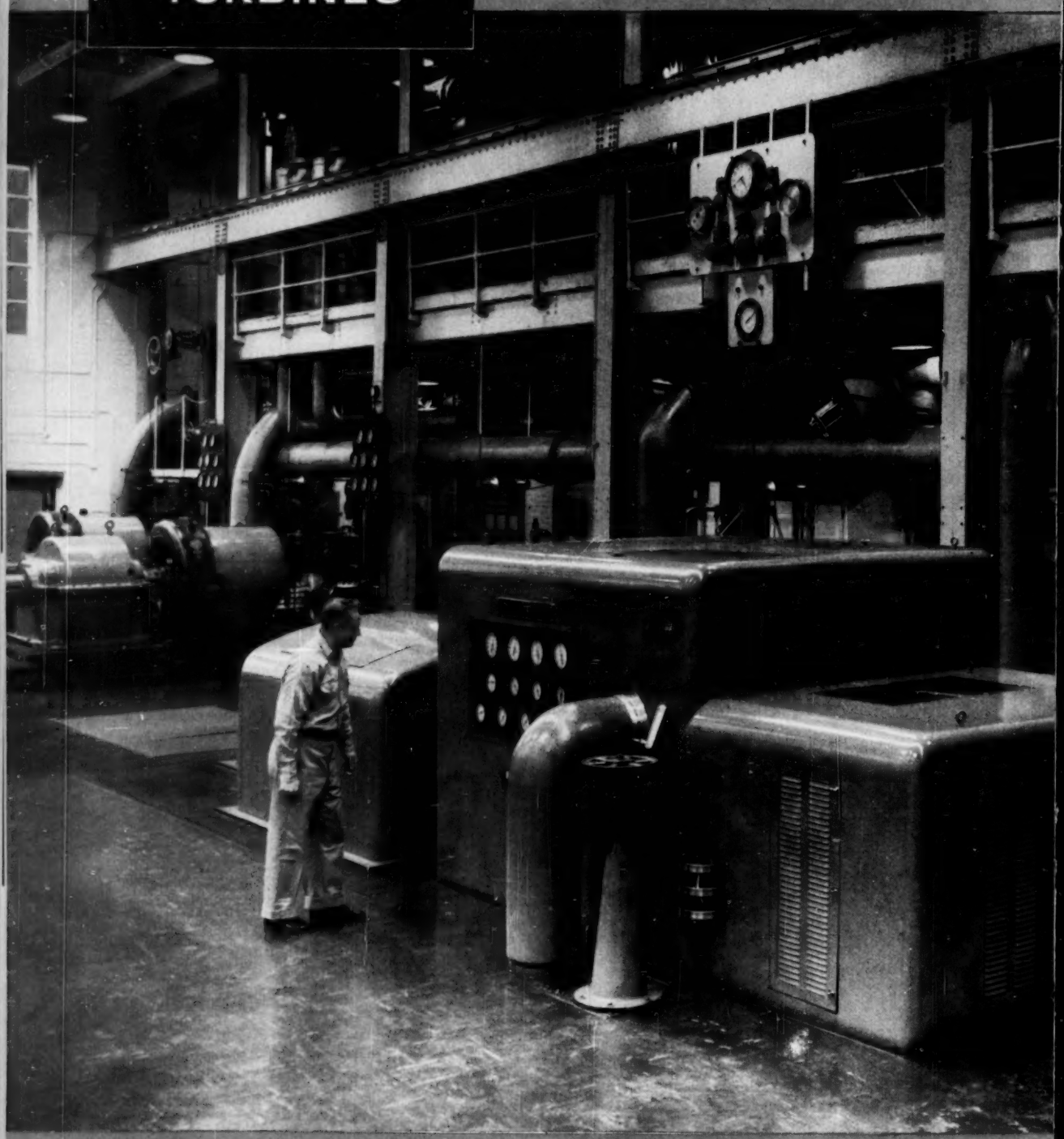
DE LAVAL STEAM TURBINES

for process industries



The photograph above shows a De Laval direct-connected turbine generator installation at Parke, Davis & Co., Detroit, Michigan.

This controlled extraction, controlled back-pressure unit supplies 2000 kw using process steam. Extraction is at 130 psig, exhaust is 5 psig. This new machine was added to already existing De Laval units that have been in service for 30 years. In addition, the Parke-Davis Research Laboratories in Ann Arbor, Michigan will soon be using a new 1000 kw unit.

DL-440

Parke, Davis & Co. uses DE LAVAL Steam Turbines for process and power generation

Proved economy, dependable service

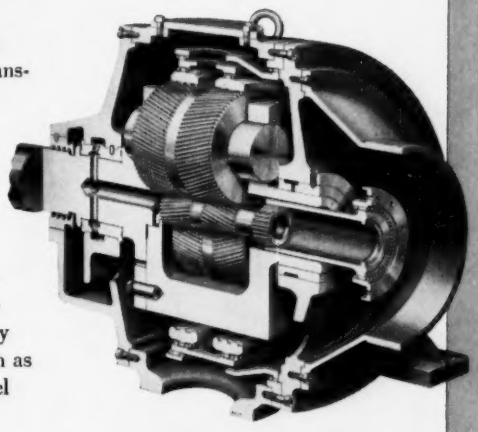
In many process industries, an important by-product is economical electric power. If appreciable quantities of process steam are used, power generation can be achieved at comparatively low cost.

De Laval, pioneer in high speed rotating machinery, has continued to maintain engineering and manufacturing leadership. If you have process application where low-cost power generation can be utilized, call on De Laval.

De Laval-Stoeckicht Planetary Gears

In many applications where high speed and high horsepower are transmitted, the De Laval-Stoeckicht planetary gear can be used to great advantage. It is also used as a speed increaser or decreaser in many industrial installations.

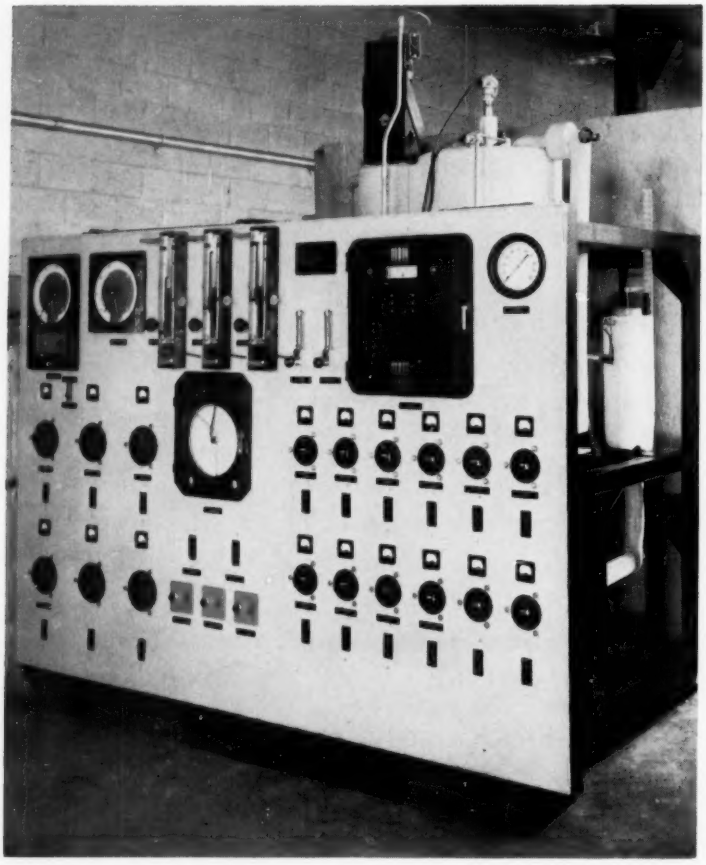
Among its outstanding characteristics are light weight, in-line construction and space saving. It may be used for all kinds of drives such as gas turbines, steam turbines, diesel engines, etc.



Write for Bulletin 2400

DE LAVAL *Steam Turbine Company*

883 NOTTINGHAM WAY, TRENTON 2, N. J.



Flash-Curve Pilot Plant

Compact unit provides information for the designer and operator of petroleum-refinery flash towers.

Back in 1948, Gulf Oil Corp. developed a pilot plant designed to provide equilibrium flash data for the evaluation of refinery crude stocks. Artisan Metal Products, Inc., updated the original design and, in June of 1958, completed fabrication of a packaged version of the pilot plant for Gulf's Refinery Technology Laboratory. Under license from Gulf, Artisan is now offering the package on the open market.

Chief function of the unit is to flash a hydrocarbon charge stock at several different temperatures under equilibrium conditions. A plot of output data (% vaporized vs. temperature) helps determine the production yield for that charge stock, and aids design of large-scale process equipment.

Secondary function of unit is to furnish large samples for continuous runs in pilot plants used for study of other refinery operations.

Design feed rate is 100 to 1,000 cc./hr. of reduced crude; however, the Gulf Laboratory unit has shown ability to operate at feed rates up to 3,000 cc./hr.

Maximum flash temperature (corrected to atm. pressure) thus far attained is 1,172 F. The system can operate at pressures as low as 1 mm. Hg.

► **How It Works**—Charge stock flows from the feed tank through a metering pump and preheater coil into the flash still. An electrically heated molten-salt bath and circulating leg maintains desired preheater and vaporization-chamber temperatures. Voltage input to several heating tapes on the feed tank and lines helps to control process temperatures.

Flashed vapors exit through a jacketed pipe condenser and collect in overhead onstream receivers. A layer of berl saddles in the upper section of the flash chamber stops entrainment.

Bottoms drain off via a loop seal to the onstream bottoms receiver. Any organic materials in the noncondensibles are condensed out in a dry-ice cold trap before they reach the mechanical vacuum pumping system.

At present, the packaged unit sells for $22,000. This price includes all vessels, pumps, piping and complete instrumentation.—**Artisan Metal Products, Inc., Waltham, Mass.** 92A

UNION 20-S

Announcing a New Source for:

pipe

tube

strip

sheet

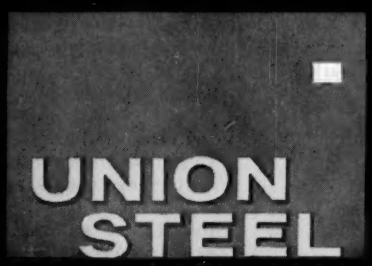
plate

bar

wire

in stock for immediate delivery.

Described in Bulletin 20-S.



leadership through research

UNION STEEL CORPORATION

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STAINLESS and SPECIALTY STEELS - exclusively

Variable-Speed Drive

Output shaft at right angles to transmission.

Because Speed-Trol variable-speed drives mount directly to the drive shaft, all intermediate transmission elements, such as couplings and sprockets, are eliminated. According to the manufacturer, Speed-Trol is the first shaft-mounted mechanical variable-speed drive to reach commercial markets.

Offered in drip-proof or totally-enclosed constructions, the ¼- to 3-hp. units feature speeds from 360 to 5.2 rpm. and speed variations from 2:1 to 10:1. A wide variety of electrical and mechanical modifications is also available. — **Sterling Electric Motors, Los Angeles, Calif. 94A**

Smoke Sampler

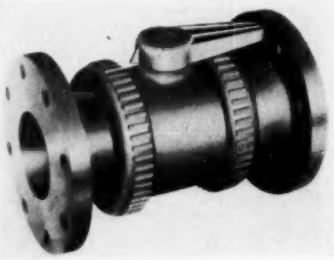
Aids pollution and process efficiency studies.

Function of the new Process Sequential Sampler is to cut down on the work required in taking dust samples from smoke stacks and vents. The device automatically collects 12 dust samples in sequence on 2-in. filter disks. Depending on the accessory vacuum pump used, air may be sampled at a rate of 2 to 4 cfm. A heated chamber that prevents moisture condensation when sampling saturated streams is optional. The sampler comes in a heavy-duty carrying case; construction is of stainless steel and anodized aluminum. Various filter materials are available.—**Gelman Instruments, Chelsea, Mich. 94B**

Cooling-Tower Supports

Long-lasting grids improve tower performance.

Glass-fiber-reinforced polyester resin is the material of construction for the molded grids that support filling splash bars in the manufacturer's crossflow cooling towers. Noncorrosive and immune to rot or decay, the new supports provide a permanently level splash bar installation that prevents water channeling with resultant loss of performance. They also assure a precisely engineered splash bar arrangement for maximum water breakup and minimized restriction to air flow.—**The Marley Co., Kansas City, Mo. 94C**



Plastic Ball Valve

For corrosion service. Several materials.

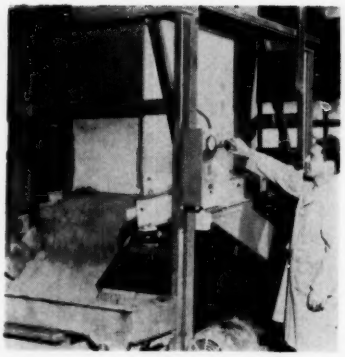
An all-plastic, molded, 4-in. ball valve for corrosion service is Venturi-throated, has straight-through nonturbulent, low-pressure-drop flow characteristics, and is fitted with 150-lb. flanges. Available in PVC Types I and II, Kralastic, polypropylene and Penton, the valve features ¼-turn shutoff.—**Chemtrol, Glenwood, Calif. 94D**

For More Information . . .

about any item in this department, circle its code number on the

Reader Service

postcard (p. 245)



Vibrating Feeder

Responds to any standard process instrumentation.

Simple in design and easy to operate, the new Amplitrol vibratory feeder features fully variable, stepless amplitude control, and the manufacturer's exclusive Natural Frequency drive.

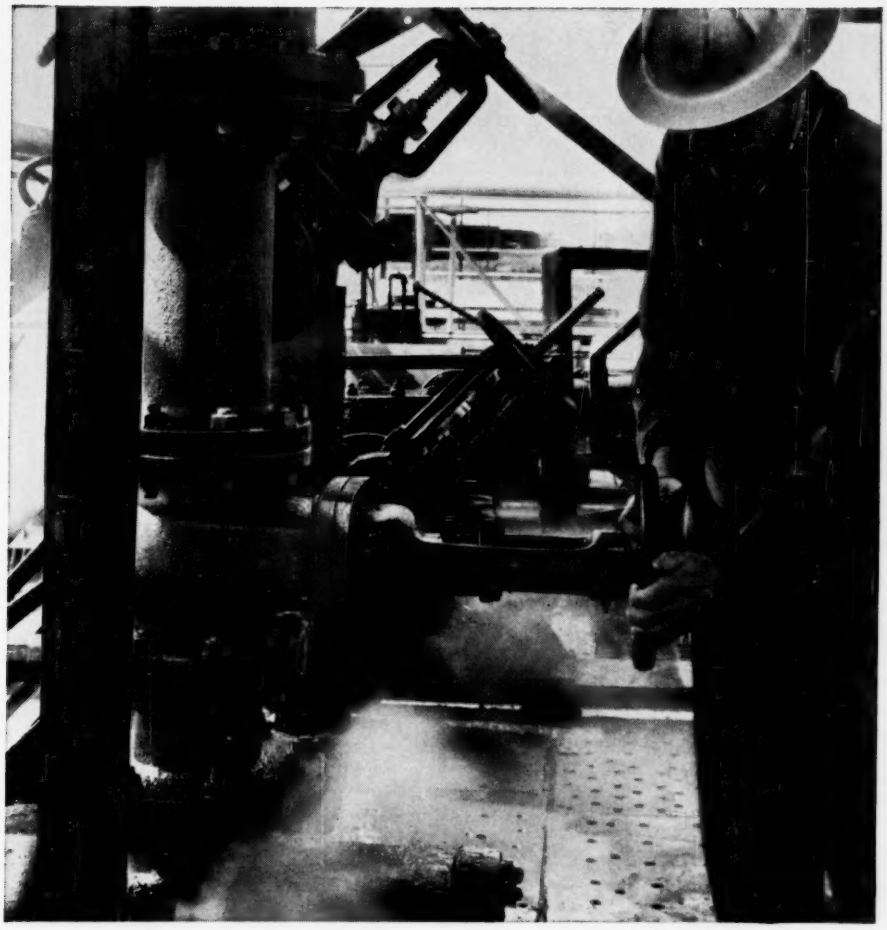
Drive units are each composed of a 900-rpm., a.c. motor-exciter mounted between two banks of heavy-duty industrial air springs. Motor-exciter and springs are set in a sturdy drive housing that mounts either above or below the steel trough. In standard models, only ½ hp. will drive troughs up to 24 in. wide by 8 ft. long.

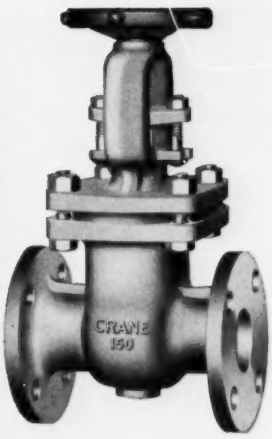
A standard control panel for both air and power supply is provided with every feeder. Control can be local or remote, manual or automatic; control responds to any standard process instrumentation. — **Carrier Conveyor, Louisville, Ky. 94E**

Shipping Container

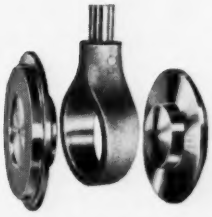
Low-cost package takes less space. Low weight.

Designed for single-trip shipment of both regulated and non-regulated liquid materials, the 15-gal. Cubitainer is a composite package consisting of a semi-rigid, cube-shaped polyethylene insert and an outer container of wirebound-box construction. The new container is a rugged, lightweight and lower-cost replacement for returnable glass carboys, 15-gal. drums and other conventional containers. Cubi-





"Craneloy 20"—No. 20045 gate valve. ½" to 12"; 150 psi at 500 F; 230 psi at 100 F.



Crane split-wedge disc design. Free-to-rotate discs employ special guides to prevent rubbing against seat during operation.

"Craneloy 20" valves—performance-proved on toughest corrosive fluids

The "Craneloy 20" gate pictured above controls highly corrosive, hot sulphuric acid sludge at a large Western refinery. While other valves in this service had to be replaced every 3 to 6 months, this Crane valve lasted a full 14 months before requiring minor repairs.

All parts in contact with the flow are "Craneloy 20"—a high-nickel, high-chromium stainless alloy—poured in Crane's own foundries.

Crane alloy valves (either "Craneloy 20" or Type 316 stainless) give you an extra measure of value. Unique design of the split-wedge disc provides *uniform* pressure all around the seating surface . . . eliminates need for high seating forces. Free-to-rotate discs minimize seating wear and prevent galling.

For details of other features and applications of Crane alloy valves, see your Crane Representative.

Get full facts on "Craneloy 20" and other Crane quality alloy valves. Ask your Crane Representative for Circular AD-2080 or write to the address given below.

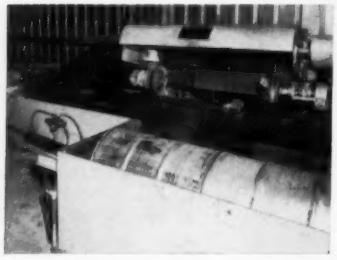
CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

tainers eliminate extensive handling, reconditioning and excessive storage-space problems.

Initial cost of Cubitainers is 80% less than that of the 13½-gal. glass carboy. They weigh 83% less than carboys and take less than half of the space.—**The Hedwin Corp., Baltimore, Md.** **94F**



Drum Cleaner

Automatic machine cuts cleaning costs in half.

Drumatic, a completely automatic drum cleaner capable of cleaning 1,500, 55-gal. drums per 8-hr. shift, is recommended for any company that reconditions 10,000 drums or more monthly. According to the makers, this automatic machine can halve drum-cleaning costs.

Each system consists of a long bath tank containing caustic solution that loosens outside coatings and inside residue. The drums revolve in solution while moving forward to a battery of brushes that cleans both end and sides. A built-in lift fork then deposits the drums, clean to bare metal, on a rinse rack.—**Drumatic Corp., San Francisco, Calif.** **96A**

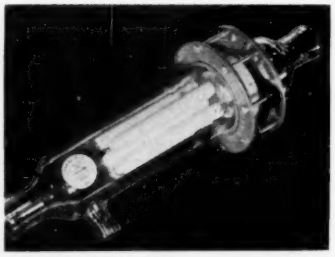
Belt Valve

Controls flow characteristics with moving belt.

Although developed for controlling the flow of hydrogen peroxide and other fluid fuels for missiles and rockets, the motorized Flexbelt valve may find process-industry application as well. Fluid flow is modulated by a belt that covers or uncovers orifices in the seat.

A plot of flow vs. belt position varies with change of geometric configuration of the port or, more simply, with geometric spacing of thin, slot orifices in the valve seat. This flexibility of control enables the manufacturer to supply valves having linear, square root, logarithmic or other characteristics.

Power to operate the valve motor is 6, 10, 15 or 18 w., depending on the speed of operation required. Standard valves are available with flows to 200 gpm. against pressures to 600 psi. Speed of operation from full open to full closed is from 0.6 to 6 sec.—**The Consolidated Controls Corp., Inglewood, Calif.** **96B**



All-Glass Filter

Retains particles of extremely small size.

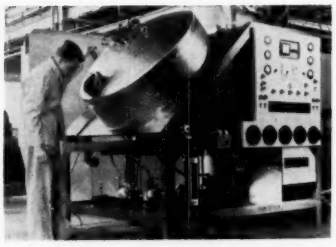
Quality control systems for process streams are a possible application for a new line of ultra-precision glass filtration instruments. Pyro-Flow all-glass filters are available in 1-, 1½- and 2-in. line sizes. The new units can retain particles ranging in size from 4 millimicrons to 200 microns. Maximum working pressure for the standard models is 50 psig.; temperatures can range from −65 to 450 F. Maximum pressure drop is 15 psi.—**Pyro-Flow, Inc., Glendale, Calif.** **96C**

Environment Probe

Detects presence of liquid, gaseous impurities.

A new type of electrical resistance probe senses environmental changes with extreme sensitivity. In theory the probe measures corrosion, but in practice, its main use will be for measuring hard-to-detect liquid and gaseous contaminants. For example, the probe can detect the slightest change in humidity, ozone concentration, water content in a nonaqueous liquid or other environmental conditions that have a tendency to attack metal.

Essential element of the probe is a vacuum-deposited metal film. Film metal varies with the application, but usually is one that is readily attacked by the compound being measured. Since the instrument connected to the probe can detect as little as five billionths of an inch of metal loss, contaminant concentration can be extremely small, yet quickly detected. If the metal surface is sensitized by chemical treatment beforehand, the device literally detects the progress of corrosion atom by atom.—**Crest Instrument Co., Santa Fe Springs, Calif.** **96D**



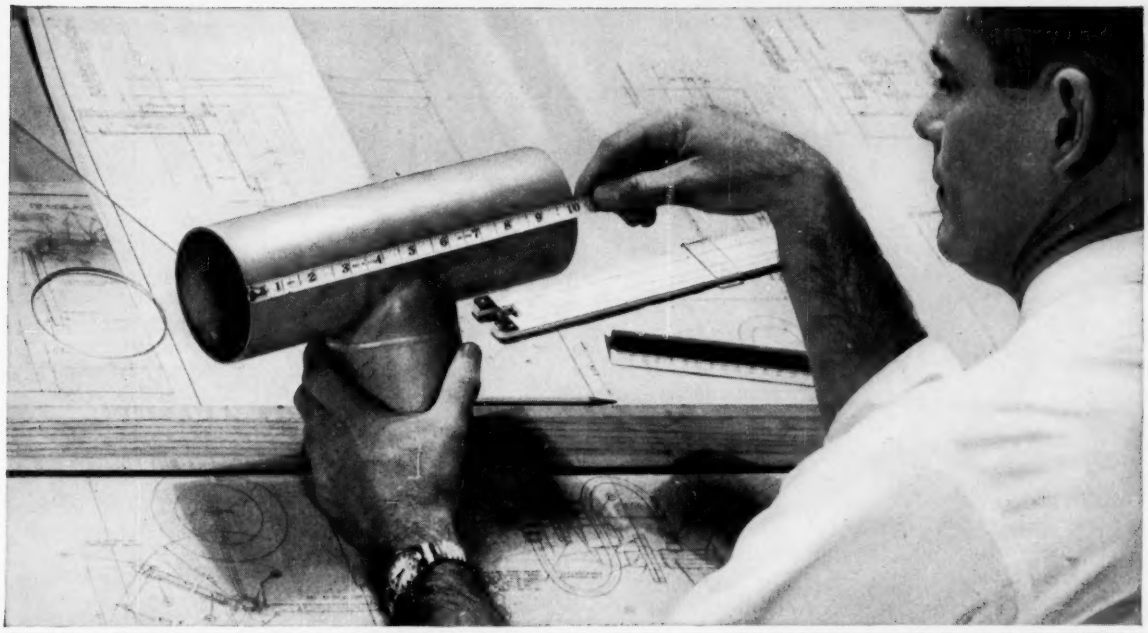
Molecular Stills

Offered for high-capacity commercial operations.

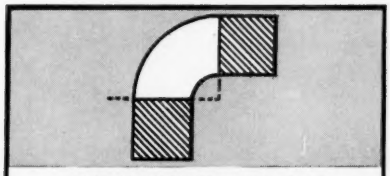
Consolidated Electrodynamics Corp. is now offering production-size molecular stills to the process industries. The machines come in two sizes—a 36-in. unit for 400 lb./hr. throughput, and a 60-in. machine for 2,000 to 4,000 lb./hr.

According to CEC, the new continuous stills can handle

EQUIPMENT NEWS
Continues on..... **Page 220**



SAVINGS ARE MEASURABLE...START TO FINISH WITH *LONGER LENGTH* SPEEDLINE FITTINGS



HERE'S HOW YOU CAN CUT PIPING COSTS

A conventional 90° elbow is shown inside the dotted line. The shaded areas indicate the extra length you get with a Speedline fitting—at no extra cost. For example, on a 3" Speedline Elbow it means 4" more pipe. Thanks to the longer length of all Speedline fittings, all types of joints are made more easily . . . cost less . . . than with conventional fittings. Make your own comparisons.

For location of Authorized Distributor nearest you, see Speedline listing on page 593 in Chemical Engineering Catalog.

With this 3" Speedline Tee you get 3¼" "*more length*" at no extra cost. Speedline's *tangential feature* cuts costs and design detailing, too . . . lets you select the best joint to meet assembly requirements . . . means more clearance for welding and easier pipe aligning. Flange where you want to, weld where you want to . . . *any* type joint can be used on *any* or *all* ends of a Speedline corrosion resistant fitting!

Greater flexibility of Speedline long length fittings adds up to faster assembly and *lower installed costs*—even for the most complex process piping system. And, of course, Speedline corrosion resistant fittings *cut material costs two ways:* they give *more* pipe length per fitting and they facilitate use of economical *light wall stainless* steel pipe.

Before you plan any new installation or system addition, investigate the many advantages of Speedline's *tangential* feature. Write for Speedline Catalog showing how you save with the complete line of Speedline fittings.

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STAINLESS STEEL FITTINGS

SPECIALLY DESIGNED FOR SCHEDULES 5 AND 10 PIPE

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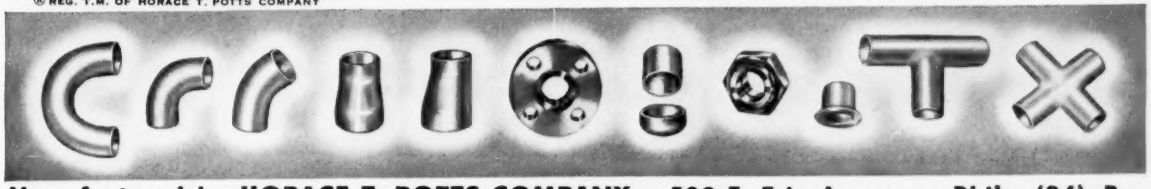

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DEVELOPMENTS . . .

CHEMICAL PRODUCTS

EDITED BY FRANCES ARNE

Plastic Magnet

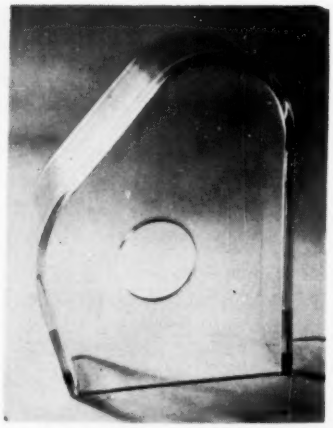
Magnetized PVC may take over important uses for latch closures.

A plasticized vinyl plastic which can be compounded and processed to react exactly like metal or ceramic magnets has been developed. For magnetic properties, the material contains barium ferrite. It can be produced in continuous lengths in an unlimited number of shapes ranging in size from spaghetti to garden hose. It can be cut without impairing its magnetic qualities.

Currently, 10 mi./wk. is being produced for use in refrigerator gasket seals. In this application, the magnetic strip is used inside a flexible vinyl plastic gasket to form a perfect airtight seal around the entire perimeter of the refrigerator door. This eliminates the need for a latch.

This flexible magnet material is actually an electrical insulator. Its permanency is said to excel most conventional magnets. Unlike iron magnets, it can be spot magnetized or shape magnetized for most efficient use. The flexible material can have poles across the width or thickness, or along one face with the two poles along the edge, or along one face with alternating poles.

In addition to refrigerator and flexible door seals, there is an excellent possibility of the use of flexible magnetic strip in similar applications for automobile glove compartment doors, compacts and other types of cases.—**B. F. Goodrich Industrial Products Co., Marietta, Ohio.** 98A



Transparent Thermoset

Machine housing shows crystal clear results of casting new epoxy resin.

A new kind of plastic material, crystal-clear Maraglas resin 655, has been added to Marblette Corp.'s Maraset epoxy line. As a thermosetting material which is ordinarily not remeltable after hardening, Maraglas resists high temperatures, unlike thermoplastics subject to heat damage or distortion. Castable by relatively unskilled workmen without complex equipment, it is suitable for general use in any plant, without recourse to specialists needed for the complicated and difficult casting of transparent thermoplastics.

It provides 90% light transmission, does not discolor, and has low shrinkage (0.0025 in./in.). It is said to produce bubble-free castings which have hard, weather-resistant surfaces that are free of tackiness and do not craze or crack.

The resin is supplied as a low-viscosity liquid which does not need melting before simple blending with a liquid hardner. Uses include the making of models, prototypes, machine housings, lighting fixtures, panels and structural parts, tubes and piping, and encapsulation of electronic apparatus.—**Marblette Corp., Long Island City, N. Y.** 98B

Silicone Rubber

New fibrous form resembles sponge and foam in properties.

A new silicone rubber product, fibrous in nature, somewhat resembles sponge and foam in properties. Inherent premeability of the material, however, suggests applications which cannot be met by sponge or foam.

Called Cohrlastic FSR, it is a mat of silicone rubber fibers, oriented in a completely random manner. This orientation results in a product which has tensile and tear strength superior to silicone sponge and foam.

Properties of the fibrous

LINDE packaged oxygen plant sets nine-year record for availability!

THE LINDE oxygen plant shown here has been serving a leading chemicals producer "over-the-fence" continuously since 1949. Its operating log shows a 98%+ availability factor. Next year, capacity will go up from 360 to 800 tons of oxygen a day.

You can expect the same continuity of supply with a LINDE packaged plant serving your process. Your LINDE plant will be the product of fifty years' experience in the design, manufacture, and operation of air separation plants and low temperature equipment. LINDE is uniquely qualified to provide air separation plants for the supply of oxygen and/or nitrogen as well as the associated low temperature equipment for:

liquefying hydrogen, helium and fluorine
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separating hydrogen from coke oven gas
ammonia and methanol synthesis
upgrading of natural gas
other extremely low temperature processes.

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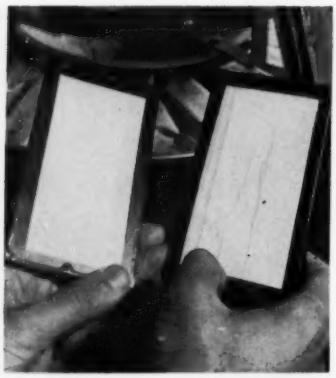
UNION CARBIDE

Industries that regularly require large quantities of oxygen or other atmospheric gases can obtain those they need from a LINDE plant on their own sites. The oxygen plant illustrated—built, owned, and operated by LINDE—is at a plant of one of the nation's largest chemical processors.

product include: high permeability, good tear resistance and tensile strength, density in the range of 20 lb./cu. ft., good compression-deflection characteristics, usable temperature range from −65 to 500 F.

The product is presently available from pilot plant equipment in sheets ¼ in. thick, 9 in. wide, 6 ft. long. Continuous lengths, larger widths and various thicknesses are anticipated. —**Connecticut Hard Rubber Co., New Haven, Conn.** 98C



Polyvinyl Fluoride Film

Exposed as a laminate for 3,000 hr. in weatherometer, unmarred surface contrasts with painted surface.

Production of Type R polyvinyl fluoride film has begun in a semi-works facility at Buffalo, N. Y., and developmental quantities are now available.

The new transparent film has outstanding weathering characteristics coupled with excellent chemical resistance and mechanical strength.

Early laboratory samples of unsupported film have not embrittled or discolored after ten years' exposure in Florida, and researchers predict that film applied as a finish on laminates will have a useful life more than double that of unsupported film.

Long term resistance to a wide range of chemicals including such highly reactive materials as 10% sulfuric acid, 10% sodium hydroxide, and carbon tetrachloride is excellent. The new film is nonplasticized, exhibits high tensile strength and flex life, and is usable in products requiring operation at temperatures between −100 F. and 250 F.

Type R film appears promising for agricultural glazing as well as inflatable structures and other types of glazing because of its toughness and unusually long outdoor life.

In the electrical industry, it offers a dielectric constant of 7.5 at 68 F. and 60 cycles, outstanding resistance to thermal degradation and high dielectric strength.

In laminations to formable and reinforced plastics, Type R film exhibits excellent dimensional stability and mechanical support at processing temperatures as high as 33 F.—**Du Pont Co., Wilmington, Del.** 100A

Polyethylene Coating

Features superior grease and moisture resistance.

A new grease resistant coating is said to have performance characteristics equal in most cases to laminations.

The coating, a 100% polyethylene blend made up of A-C polyethylene and other polyethylenes, can be applied with a conventional reverse roll coater.

Standard grease-resistant tests show no failure after various weights of board and paper coated with the new type material were treated to three weeks of continuous exposure to fats and oils.

Gloss can be controlled by method of application. Abrasion resistance and toughness are excellent.

An all-surface coating of about 1 mil (13.7 lb. of resin per 3,000 sq. ft.) was found to be the most satisfactory. Moisture vapor transmission tests showed greater resistance in some cases than laminated film now in use extensively. — **Semet-Solvay Petrochemical Div., Allied Chemical Corp., N. Y.** 100B

Styrene Copolymer

Free-flowing polyelectrolyte resin promising in self-polish floor dressings.

A carboxyl containing styrene copolymer which is soluble in either alkaline or organic systems and compatible with a wide range of natural and synthetic resins is now available in commercial quantities.

Trademarked Lytron 822, the new material has shown considerable promise as the alkali soluble component in self-polishing resin emulsion and wax emulsion floor dressings. Its

Newsworthy Chemicals

	Page Number is also Reader Service Code Number
Magnetized PVC can replace door latches	98A
Casting new epoxy resin yields transparent thermoset	98B
Fibrous silicone rubber excels sponge in tensile strength	98C
Polyvinyl fluoride film stands weathering, chemicals	100A
Polyethylene coating excels in grease resistance	100B
Styrene copolymer benefits self-polishing floor dressings	100C
All-polybutadiene truck tires get rough tests	102A
Rigid urethane foams are lighter in weight	102B
Several chloroformates now available	102C
Thiolated proteins let gels form without chilling	102D
Silicon carbide bonded graphite resists thermal shock	102E
Methyl parathion stays active after 123 F. storage	102F

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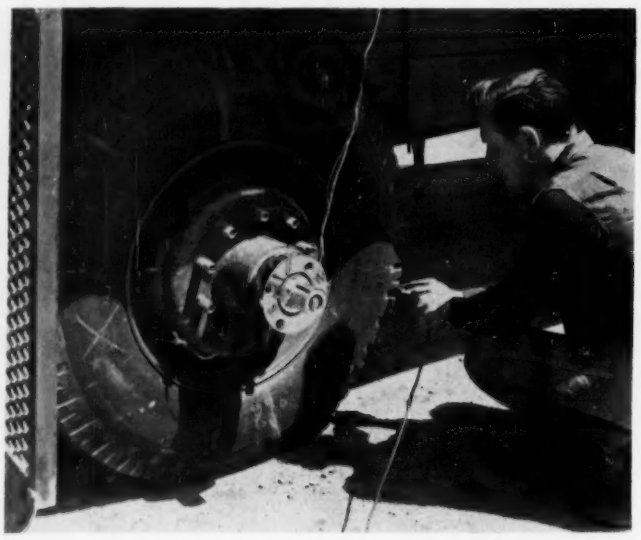

All-Polybutadiene Truck Tires Get Rough Tests

Seconds after the vehicle has come to a stop at Firestone's test center at Fort Stockton, Tex., the shoulder temperature of tire made of the company's polybutadiene rubber, Diene, is checked and recorded by an automatic electronic strip chart recorder.

Company has tested passenger and truck tires of all or part Diene for 500,000 mi. under all conditions such as under-inflation and over-inflation, underload and overload. Designed primarily as an extending rubber, Diene will be made at a 30,000-ton/yr. plant planned for Orange, Tex., and announced early this year.

Unlike cis-polybutadiene made in pilot quantity by Phillips Petroleum, Firestone product is made with Li catalyst whose yield is not a high cis product, but rather an intermediate cis polybutadiene.

Proposed Diene plant will be able to turn out the company's polyisoprene rubber, Coral, as an alternate product. Coral test hours add up to 2-million mi.—**Firestone Tire & Rubber Co., Akron, Ohio.** 102A

low molecular weight permits low viscosity solutions previously impossible with compounds of this type. At the same time, it exhibits the properties typical of a good protective colloid, dispersing agent, pigment binder and emulsifier.

Other suggested applications: clear and pigmented protective coatings, inks, adhesives, electrical component coatings, cosmetics and toiletries. Price is 50¢/lb. in bulk quantities.—**Monsanto Chemical Co., Springfield, Mass.** 100C

BRIEFS

Rigid urethane foam systems, available in both Freon and non-Freon formulas, can be foamed to lighter weights than any previously available, have very low thermal conductivity and high flowability.—**Nopco Chemical Co., North Arlington, N. J.** 102B

Isopropyl chloroformate, glycol bis chloroformate, diglycol bis chloroformate and butadiene monoxide are now available in limited quantities and are of interest to the plastics, textile and pharmaceutical fields. — **Columbia-Southern Chemical Corp., Pittsburgh, Pa.** 102C

Thiolated proteins are available in a new series called Thiogel-20. Thiolation of gelatin gives it the ability to form a gel without necessity of chilling; gel does not redissolve even in boiling water. Use is expected in vehicles for pharmaceuticals, special emulsions for photographic developing and printing, for special finishes for papers and textiles.—**Schwartz Laboratories, Inc., Mount Vernon, N. Y.** 102D

Silicon carbide bonded graphite called GRB weighs only 2.3 to 2.8 gm./cc. and is unusually resistant to thermal shock and erosion. The 60 to 90 wt. % silicon carbide content surrounds and bonds graphite particles, contributes hardness, oxidation and erosion resistance, high thermal conductivity and decomposition temperature (4,500 F.) while graphite contributes thermal shock resistance.—**Carborundum Co., Niagara Falls, N. Y.** 102E

Stabilized methyl parathion for dust formulations shows less than 10% loss of activity after 12 weeks of storage at a constant 123 F.—**Monsanto Chemical, St. Louis, Mo.** 102F

For More Information . . .

about any item in this department, circle its code number on the

Reader Service

postcard (p. 245)

Five large mounds of solar salt, harvested from huge ponds of salt water at a Morton plant in the West, await shipment to industry.

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Morton has two or more sources for any grade of salt you might use. This means Morton is better equipped to make delivery from alternate plants, even under adverse conditions that might otherwise endanger the continuous operation of your plant.

Morton delivers salt by boat, barge, truck and rail. This means you can get fast delivery on a bag to thousands of tons, anywhere in the country.

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My title was "Process Operator." Really I was just a cleaning lady for a roomful of blocked-up flowmeters. Took half my time taking them apart and putting them together again and the other half cleaning them out. I tried *everything* . . . bottle brushes, live steam, chinese backscratchers, aqua regia. The last straw was the plumbers' helper my wife gave me for my birthday.

I was all set to turn in my wrenches and plunger when a new kind of meter came in from Fischer & Porter. They call it a Magnetic Flowmeter. I stuck my hand in to see what new obstruction they'd dreamed up for me. But my hand went clean through and out the other end! I couldn't believe it.

NOW I believe it all right. Everything is changed. No more bottle brushes . . . no wrenches . . . no plumbers' helper. Nothing but a lot of grey boxes. NOW I know all about F&P Magnetic Flowmeters. And I can tell you that if *you're* tired of breaking lines to clean out meters, *you can throw your apron away!* Get the facts on a man's flowmeter. Write for Catalog 10D1416, Fischer & Porter Company, 159 County Line Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.

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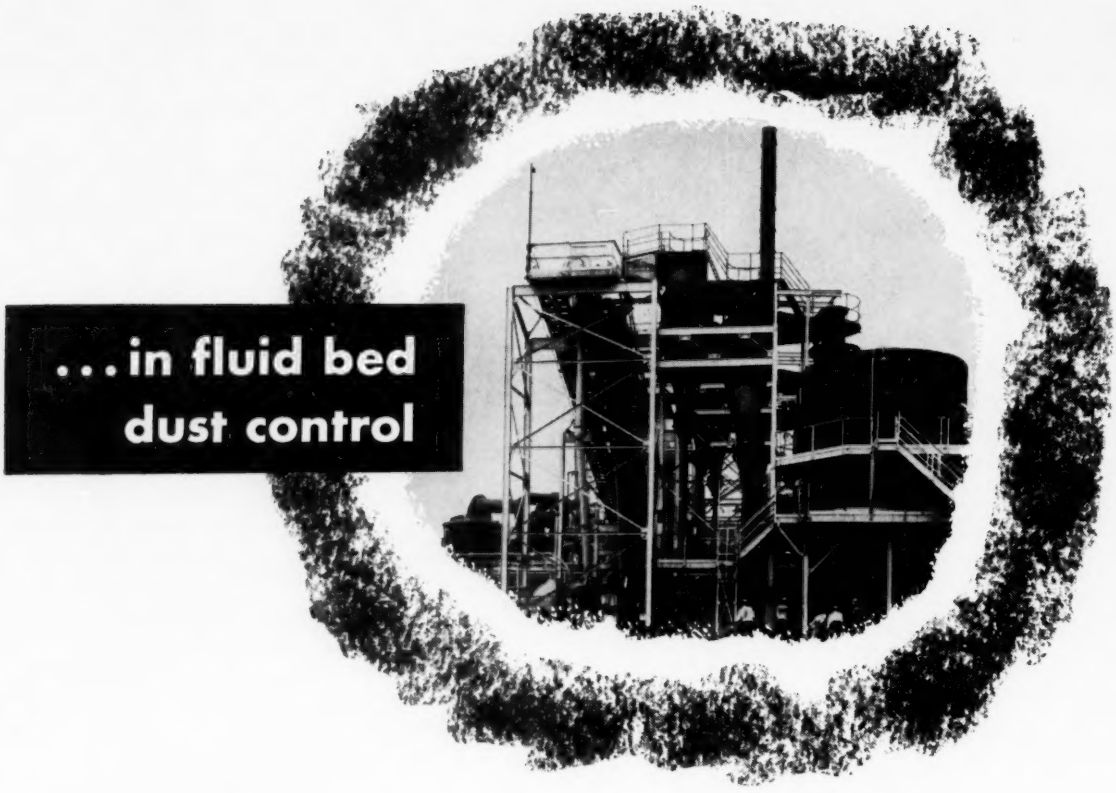

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DUCLONE high efficiency cyclone dust collectors are designed and constructed to take unusual service conditions in stride. That's why they have gained wide acceptance in fluid bed processes, such as the one illustrated for pyrite roasting to produce sulfur dioxide for manufacture of sulfuric acid. A special refractory lined primary Duclone and stainless steel secondary Duclones were supplied by Ducon to insure continuous operation under the inherent high temperature and corrosive conditions of the process.

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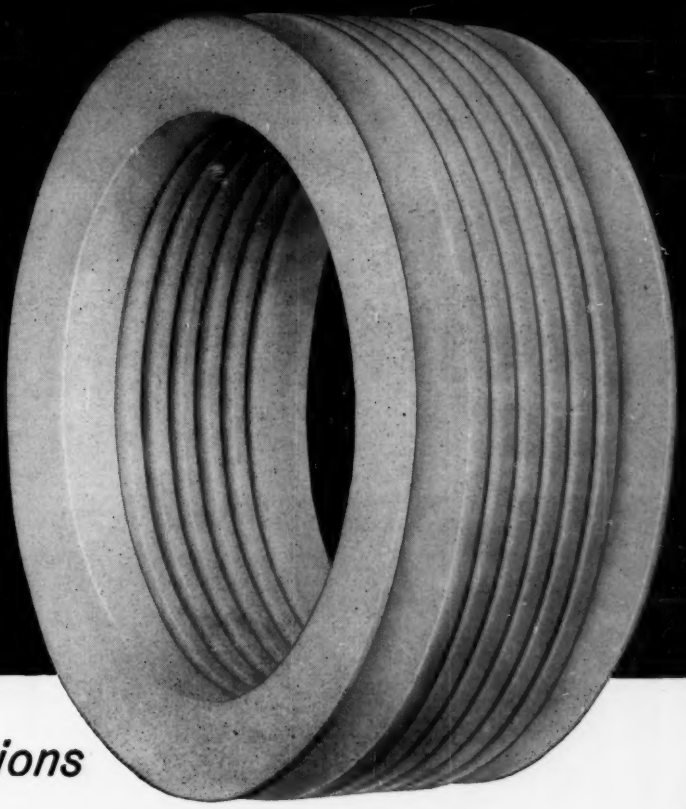

Under corrosive conditions

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Garlock All-Teflon* Expansion Joints act as a cushion to absorb pump, compressor, engine and pressure surges . . . prevent stress, compensate for misalignment, reduce flange breakage . . . for service to 75 P.S.I. against solvents, acids, caustics. **Teflon-Lined Expansion Joints** are recommended where pressures rise as high as 125 P.S.I.

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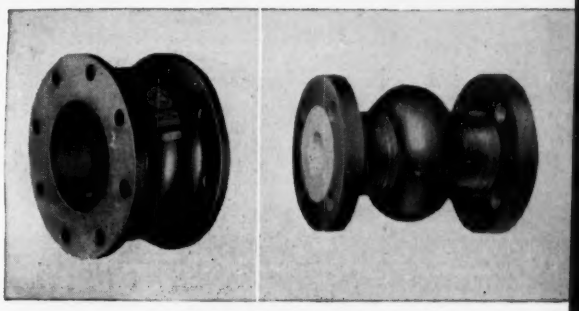

Garlock All-Rubber Expansion Joint (left) and Teflon-Lined Rubber Expansion Joint (right).

*DuPont Trademark for T.F.E.-fluorocarbon resin

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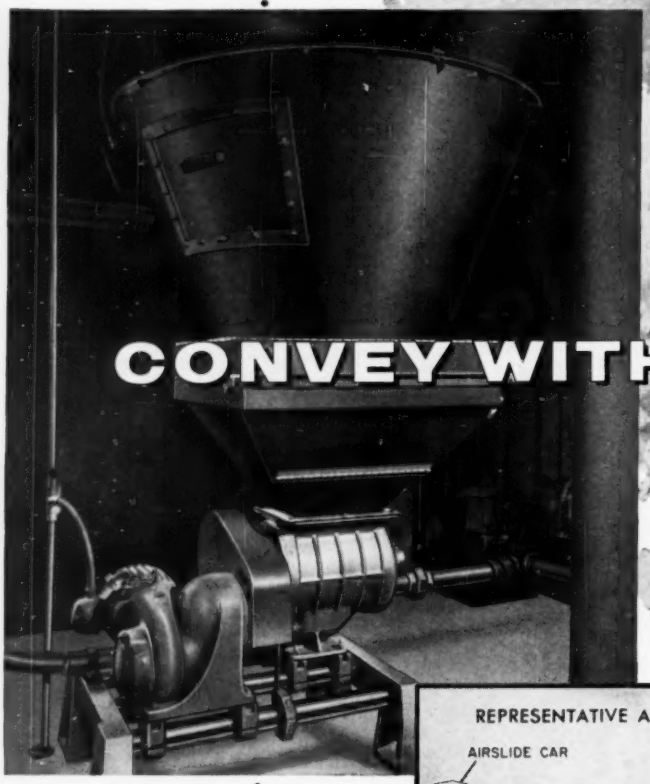

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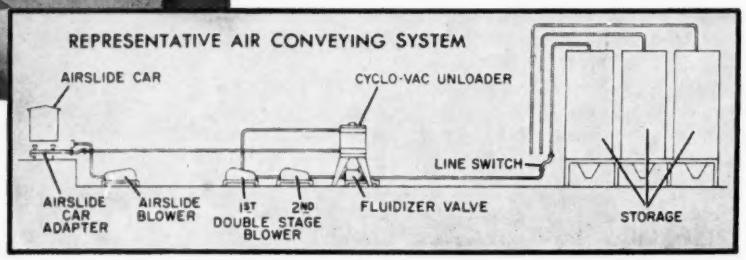

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Buffalo—Danforth & Cunningham (Orchard Park)
Louisville—E. Diatikar Co. (Jeffersonville)

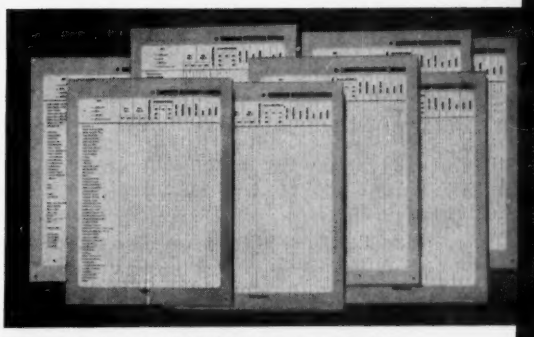
Now you can predict service life because Byers PVC Pipe Engineering brings a factual approach to piping system design

FACT: 400 corrosion resistance ratings are available for Byers PVC Pipe

The ability of Byers PVC Pipe to handle various corrosive media is down in black and white. There are a number of tables available from Byers Engineering Service Department listing corrosion resistance ratings. Actual laboratory tests helped to determine these ratings. And we present them on a comparative basis with several metallic pipe materials.

Since ratings appear only for 72°F and 140°F, these tables do not show all applicable ranges for Byers PVC Pipe. So if applications arise where you need more information, at a specific temperature and concentration, check with us.

Remember—as in metals—concentration, temperatures and stress influence corrosion rates of PVC. Type I PVC displays considerably greater corrosion resistance than Type II, which is best where high impact resistance is the prime consideration. More of this story is available from the Byers field service representative. Call him, soon. **A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.**



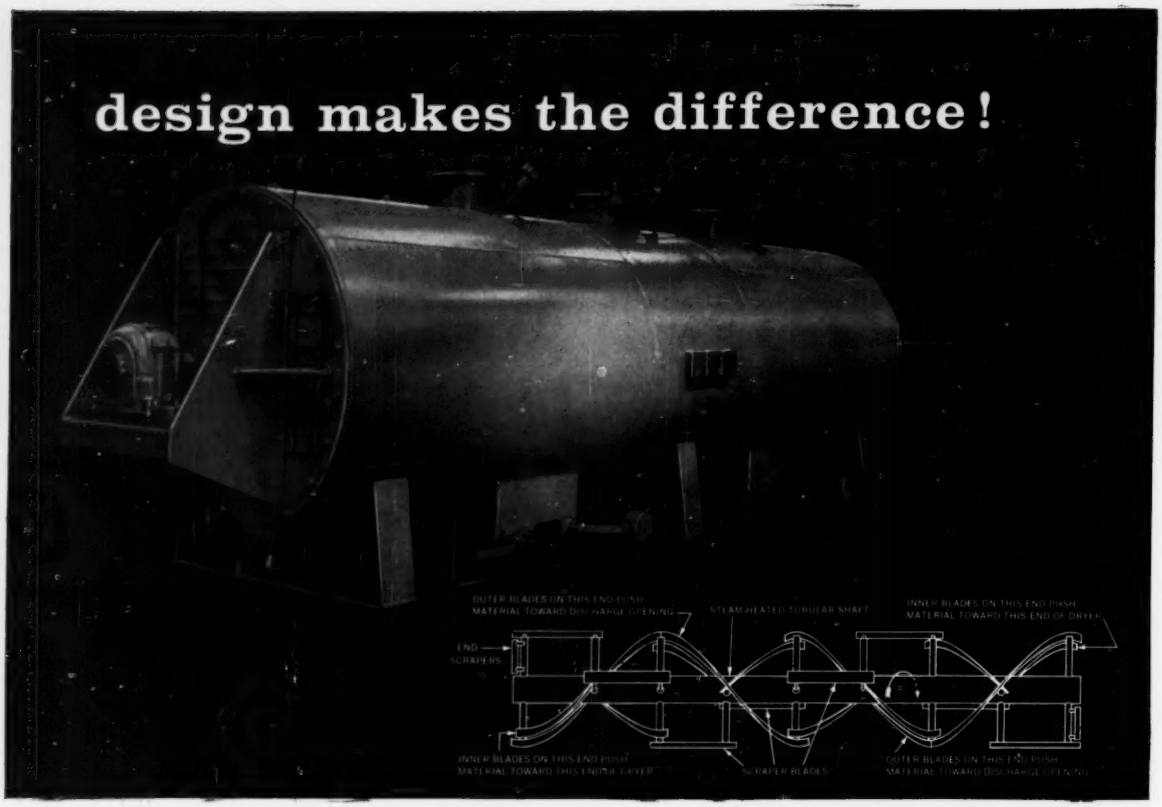
Resistance ratings are divided into four categories: E for excellent, G for good, L for limited, and U for unsatisfactory. In applications where PVC is rated as "good" and "limited" it will still display considerable resistance, in most cases higher than that of metal pipe materials.

BYERS PVC PIPE

ALSO SHEET AND ROD STOCK

Write our Engineering Service Department for copy of this new 32-page illustrated catalog on Byers PVC Pipe.

design makes the difference!


OUTER BLADES ON THIS END PUSH MATERIAL TOWARD DISCHARGE OPENING
STEAM-HEATED TUBULAR SHAFT
INNER BLADES ON THIS END PUSH MATERIAL TOWARD THIS END OF DRYER
END SCRAPERS
INNER BLADES ON THIS END PUSH MATERIAL TOWARD THIS END OF DRYER
SCRAPER BLADES
OUTER BLADES ON THIS END PUSH MATERIAL TOWARD DISCHARGE OPENING

Unique agitator design speeds production in Stokes rotary vacuum dryers

There's only one sure way to lower drying costs and boost production—remove more moisture from more material in less time. This double-spiral agitator . . . exclusive with Stokes rotary vacuum dryers . . . does just that.

The double spiral keeps all the material moving . . . continuously mixes and braids it, puts all parts of the load in contact with heated drying surfaces, and eliminates agglomerates. Production is further speeded by the steam-heated agitator shaft and arms, which increase effective drying surface up to 25%. And the smooth, even operation of the entire unit minimizes load fluctuations, keeps power requirements low.

To assure complete product discharge, Stokes custom fits each assembly to its dryer shell. Blade clearance is adjustable down to $\frac{1}{8}$ inch.

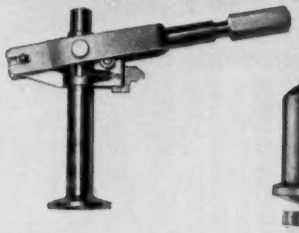
Functional features like these—the result of Stokes' long experience in designing and manufacturing vacuum process equipment—are found throughout the entire rotary vacuum dryer. Equally important features are built into Stokes cone vacuum dryers, drum dryers and flakers for the chemical and processing industries. In each case, Stokes design is your guarantee of unequalled efficiency and economy.

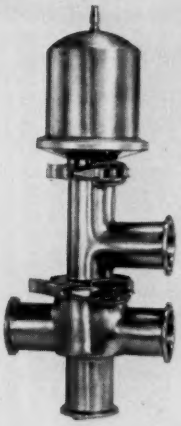
Stokes Advisory and Engineering Service, with its fully-equipped laboratory, is available to help you solve drying problems and plan for profitable production. For full information, write to Stokes or contact your nearest Stokes office.

Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

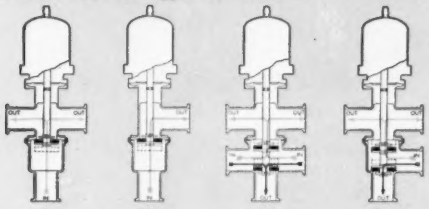
TRI-CLOVER
Air Actuated VALVES
to meet a wide range of Dairy, Food and Beverage processing operations





Above: Close-up of handle assembly which replaces air actuator when manually-operated valves are required. *Right:* Close-up of new Tri-Clover Air-Actuated Valve, with air actuator in place, showing how units are easily assembled with Tri-Clamp joints. (Valves also available in Bevel Seat construction)

The drawings below show the various Tri-Clover Air-Actuated Valve arrangements available. The *black* arrows show inlet and outlet ports when the plug is in the "UP" position. Inlets and outlets when the plug is lowered to the "DOWN" position are indicated with the *green* arrows. Valves are available in 1½" and 2" O.D. sizes as standard. Data on sizes up to 4" available on application. (Note that both single-acting and double-acting valve types are available.)



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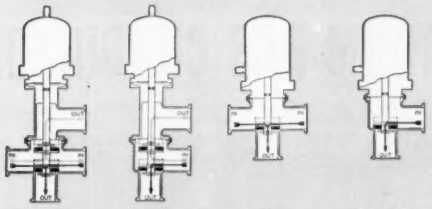
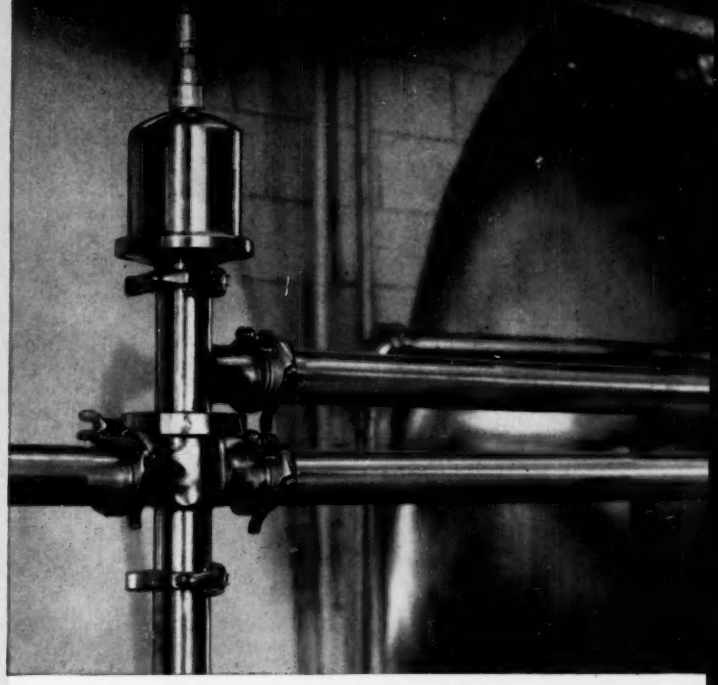


69TC 69TT 71C 71T



Tri-Clover Division's Air-Actuated Sanitary Valves permit easy application of automation and automatic control to many phases of processing and cleaning operations in the dairy, food, and beverage industries. These efficient, air-actuated valves can be locally controlled . . . or remote-controlled from any plant area. Advanced design makes them ideal for use in completely automated installation, such as recirculation operations for in-place cleaning . . . or in a single operation, such as on a filling machine. Manufactured from type 304 stainless steel, these efficient, remote-controlled valves offer fast, positive liquid flow control in any line location, with accurate local or remote control.

Built to extremely high sanitary standards, Tri-Clover Air-Actuated Sanitary Valves assure maximum uninterrupted flow, with a minimum of agitation and friction.

For full details, write for Bulletin A-658, or see your nearest Tri-Clover Distributor.

LADISH CO.
Tri-Clover Division
Kenosha Wisconsin

IN CANADA: Brantford, Ontario
EXPORT DEPT.: 8 South Michigan Ave., Chicago 3, U. S. A. Cable: TRICLO, Chicago

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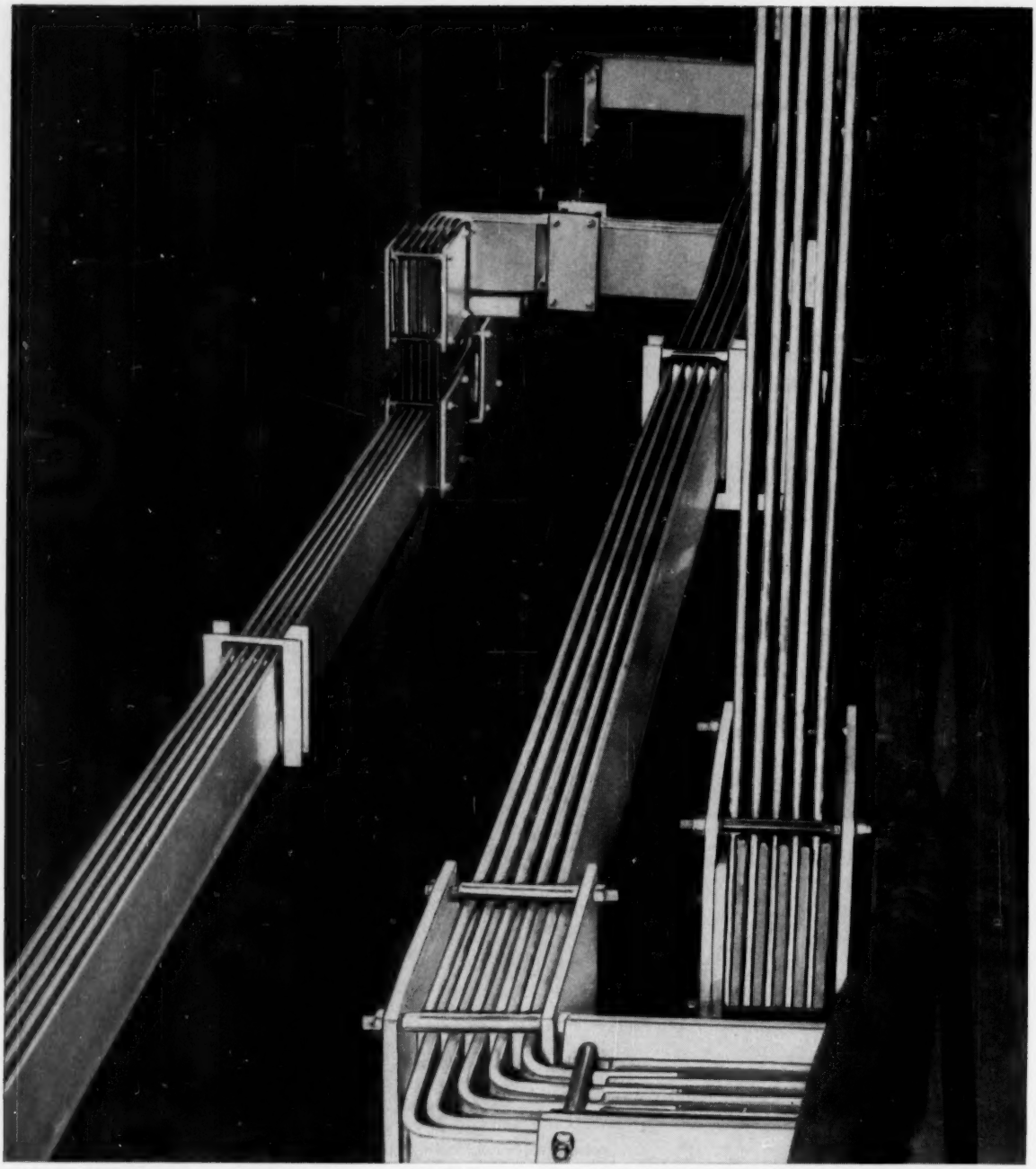
3-858



Titanium Melter Economizes With Low-Cost ALCOA ALUMINUM BUS CONDUCTOR

Substantial savings in initial cost accounted for the choice of Alcoa® Aluminum Bus Conductor for Oregon Metallurgical's titanium and refractory metals melting plant. In fact, savings of up to 50 per cent are common when you specify bus conductor of Alcoa Aluminum. With Alcoa Aluminum, you buy equivalent conductivity with only half as many pounds of metal.

Low material cost, low installation and maintenance costs plus easy-to-make connections are strong reasons to use Alcoa Aluminum Bus Conductor. Immediate delivery of rectangular shapes in popular sizes is available from Alcoa or your Alcoa Distributor. For complete information, write for your copy of the *Alcoa Aluminum Bus Conductor Handbook*. Aluminum Company of America, 2120-E Alcoa Building, Pittsburgh 19, Pennsylvania.

Photo above shows Alcoa Aluminum ½" x 9" rectangular bus bar installed at the Oregon Metallurgical Corporation's Albany, Oregon, melting plant.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV

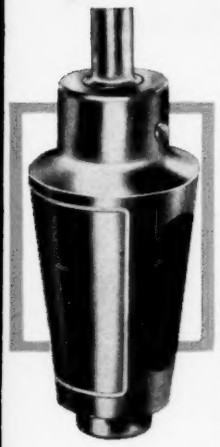
NO LEAKAGE...

You're looking at the newest thing in valves . . .

STOCKHAM'S NEW WEDGEPLUG* "O-SEAL" VALVE

Two Teflon** "O" rings in the plug give constant vapor-tight shut-off . . . to give you double assurance of double savings on operating and maintenance costs.

NO LUBRICATION...



HOW TEFLON "O" RINGS WORK The two Teflon "O" rings are inserted in dovetail grooves machined on the face of the plug. These "O" rings seat on the raised body seats when the plug is in closed position.

CONSTANT VAPOR-TIGHT SHUT-OFF This sealing effect of the "O" rings gives absolute shut-off in all cases—shut-off that remains permanently "bubble tight." The Teflon "O" rings are chemically inert, practically frictionless, and will not cold flow.

TESTS PROVE POSITIVE SHUT-OFF

Hundreds of tests of this new valve in all types of services have failed to make it leak. Performance has been remarkable. In every case, the valve held "bubble tight" because of the pressure seal effect of the "O" rings.

OTHER OUTSTANDING ADVANTAGES

Non-Lubricated—no costly maintenance necessary • Provides Double-Block and Bleed in most services • Quick, Easy Operation—won't stick or bind • Double Seating for Double Safety—Ground metal-to-metal seat provides shut-off in case fire burns out "O" rings • No Product Contamination • Protected Seats

RECOMMENDED USAGES Stockham's new "O-Seal" is recommended for all general purposes—air, gas, water, steam, propane, hydrocarbons, etc., as well as for hard-to-hold services. Recommended for temperatures from minus 300°F to 400°F and not exceeding 720 psi.

Available in carbon and alloy steels, 2" - 12" sizes, 150 and 300 lb. pressures. Three port openings—40%, 70%, full round-wrench, handwheel, gear, and motor operated.

*Patented
**Teflon DuPont Trademark

STOCKHAM'S NEW WEDGEPLUG "O-SEAL" VALVE

Call Your STOCKHAM Distributor or Sales Representative for complete details, or write today for the new brochure on the Wedgeplug "O-Seal."

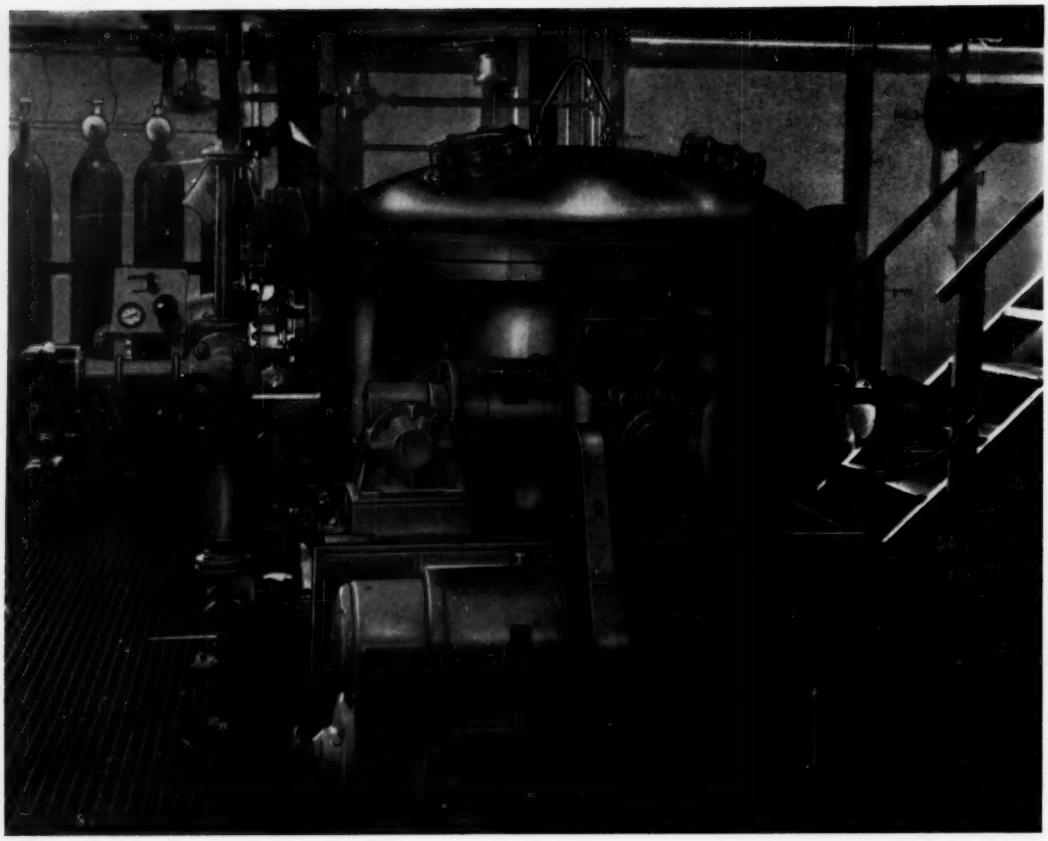
Stockham makes a **BETTER** *valve...for* **EVERY** *job!*

WEDGEPLUG VALVE COMPANY Division of →

STOCKHAM VALVES *and* **FITTINGS**

General Offices and Plant—4001 North 10th Avenue, Birmingham 2, Alabama

CAST IRON-MALLEABLE PIPE FITTINGS • BRONZE, CAST IRON, DUCTILE IRON, CAST AND FORGED STEEL VALVES



For The Upjohn Company...

CUSTOM-BUILT solution

for a filtration problem

This FEinc rotary pressure filter was designed and built recently to specifications of The Upjohn Company, Kalamazoo, Michigan. It separates organic crystals from a solvent slurry at pressures up to 30 p.s.i.

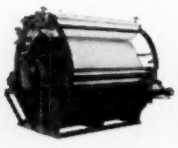
The design of this new rotary pressure scraper filter represents another achievement for Filtration Engineers in the design of filters for special applications.

If you have a problem in solvent processing . . . or any other filtration problem . . . contact Filtration Engineers for specific recommendations which are available without obligation.

Your individual requirements determine the type of filter needed, its size, construction materials and the special features necessary for highest efficiency. For more complete data, see FEinc's section in Chemical Engineering Catalog or write Dept. CEF-559.

For a Bigger Yield **FE INC®**

FILTRATION ENGINEERS
AMERICAN MACHINE AND METALS, INC.
EAST MOLINE, ILLINOIS



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HORIZONTAL

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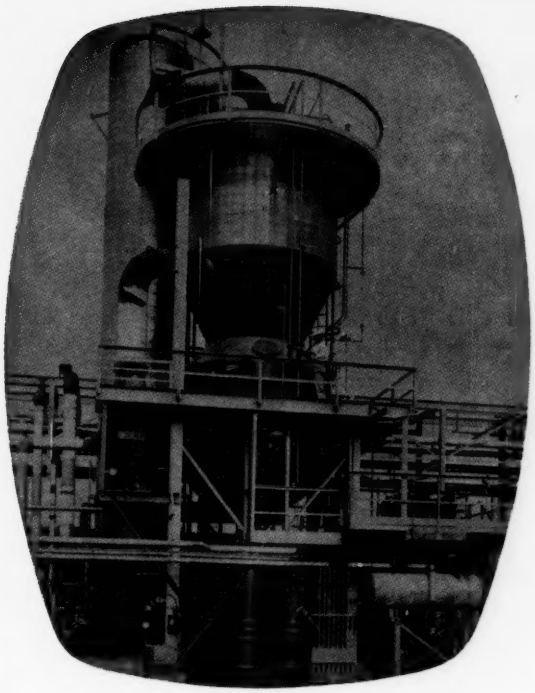
SPECIALISTS IN LIQUID-SOLIDS SEPARATION

Struthers Wells KRYSTAL®

CRYSTALLIZERS



ASSURE

product quality

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product uniformity

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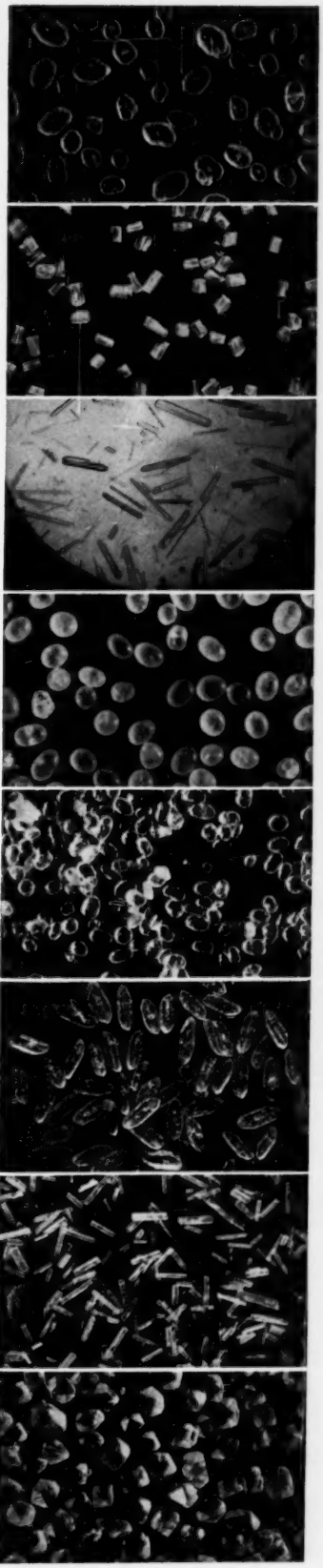
product purity



PLUS . . . Operating Economies

STRUTHERS WELLS KRYSTAL Crystallizers assure you not only product superiorities but operating advantages that include: lower centrifuging costs; less processing; dust elimination; lower drying costs; a free-flowing product; minimum caking and many other time and money-savers. Write now for Bulletin CE-57.

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STRUTHERS WELLS CORPORATION

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WARREN, PA.

Representatives in Principal Cities

Plants at Warren, Pa. and Titusville, Pa.

PROCESSING EQUIPMENT DIVISION
Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

BOILER DIVISION
BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

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Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening & Back-up Rolls

Stainless Steel Anchor Bolts Hold Down Maintenance Costs, Too

Anchor bolts made of Armco Stainless Steel not only insure secure and durable attachment of pumps, motors and other mechanical equipment to their bases, but eliminate much costly and troublesome maintenance.

In chemical plants, even those handling only mildly corrosive materials, rusting and corrosion of anchor bolts is a serious problem. Replacement is frequently a difficult, time-consuming job. Corroded bolts are subject to sudden fracture, also cause deterioration of the surrounding concrete. Equipment can work loose, with resultant damage and lost production that is more costly than failure of the equipment itself.

Low cost solution to the problem is the use of bolts made of Armco Stainless Steel, usually Types 304, 316 or Armco 17-4 PH, depending on corrosive conditions and strength requirements. For other bolting that must resist high pressures and temperatures, severe oxidizing or corrosive conditions, consider the advantages of Armco's special grades of stainless.

Get more information on Armco Stainless Steels for bolting of all kinds by contacting your Armco Stainless Steel Distributor, or mailing the coupon.

ARMCO STEEL CORPORATION, 2079 Curtis Street, Middletown, Ohio
Send me information on Armco Stainless Steels for chemical plant bolting. We are interested in bolts for the following applications:

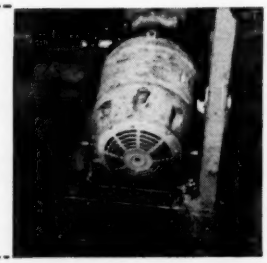
_____

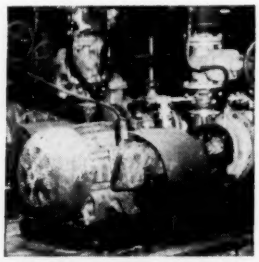
NAME_____

COMPANY_____

STREET_____

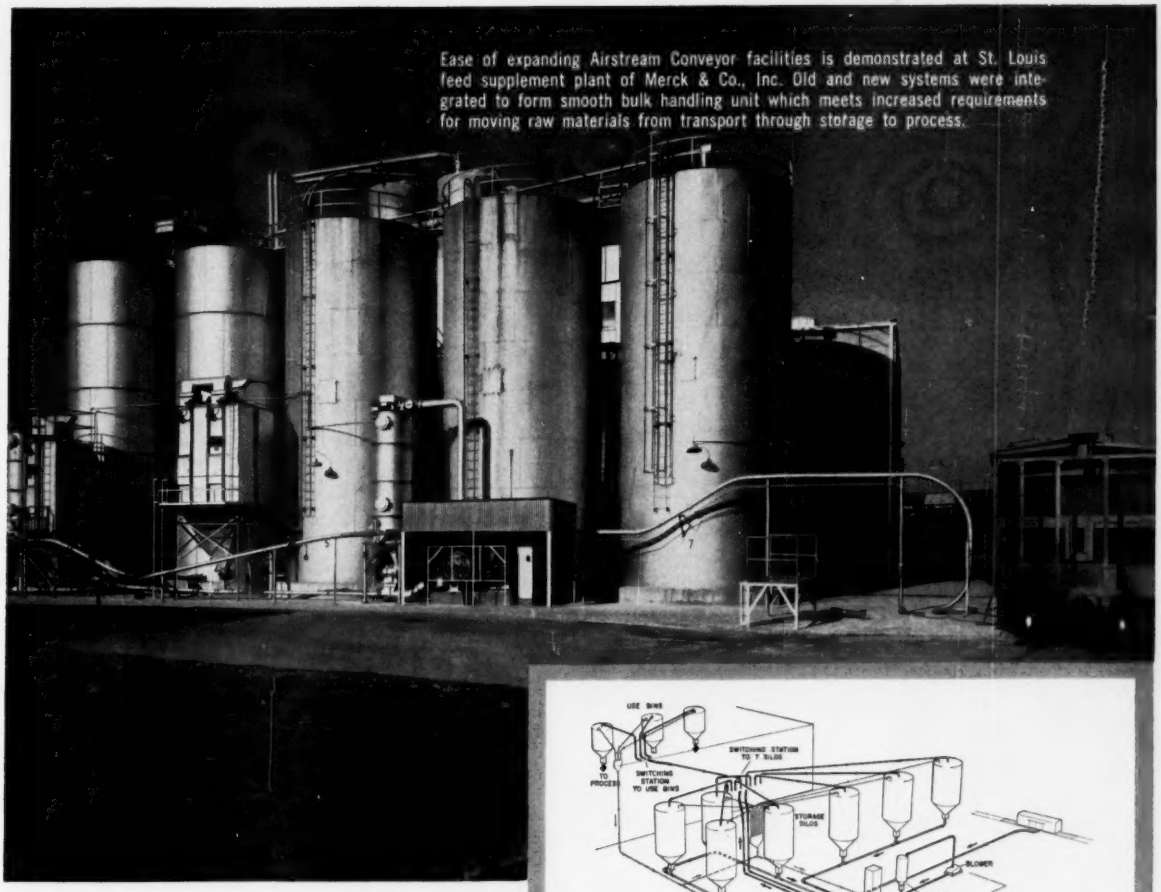
CITY_____ ZONE____ STATE_____



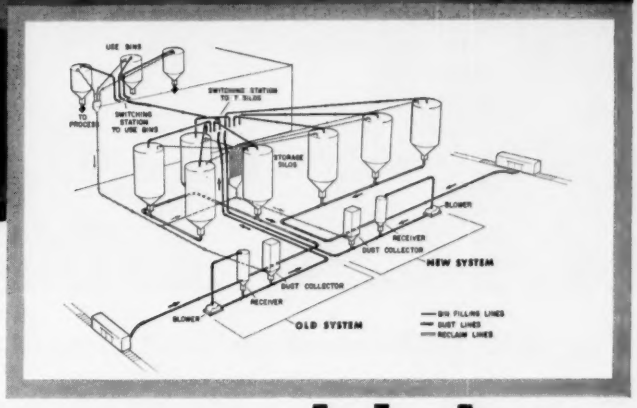


ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products



Ease of expanding Airstream Conveyor facilities is demonstrated at St. Louis feed supplement plant of Merck & Co., Inc. Old and new systems were integrated to form smooth bulk handling unit which meets increased requirements for moving raw materials from transport through storage to process.



AIRSTREAM CONVEYORS ARE . . .

easily expansible

If you plan to grow, here's a thrifty way to avoid future bulk handling problems: install a Dracco Airstream Conveyor System to meet *current* needs, expand it when and as required.

You can easily tie a new system in with the original installation. New storage facilities can be built where you want them, without regard to location of existing receiving areas. Airstream conveying lines carry your dry bulk material to its destination via the quickest route—horizontally, vertically, through walls and floors, underground or overhead. They fit any plant layout, new or old, and save you valuable space. Ground level or rooftop installation eliminates costly supporting structures.

Merck & Co. recently took advantage of these features when they expanded their ground level Airstream System. In addition, use of duplicate components in the new system cut engineering costs. This also simplifies maintenance and permits minimum parts inventory.

Benefits like these tell you why it's smart to install a bulk handling system that is engineered to help you move ahead. Call or write Dracco now for detailed information.

DRACCO DIVISION OF FULLER CO.
4040 East 116th Street • Cleveland 5, Ohio

DRACCO *airstream* conveyors
dust control equipment

(Pronounced Dray'co)

For the best in outdoor flooring

Specify BLAW-KNOX Electroforged® Steel Grating and Treads

For safe, all-weather, outdoor flooring, made to take punishment and stand the strain, specify Blaw-Knox Electroforged Steel Grating and Treads. Proven on outdoor installations in all parts of the world, Blaw-Knox grating has an established reputation for quality, durability, and safety.

Easy installation—rigid one-piece construction fits readily around pipes, beams, and equipment.

Maximum load bearing capacity—Electroforging eliminates slotting or otherwise weakening bearing bars . . . one-piece construction increases structural strength.

Safest walking surface—non-slip, twisted crossbar plus choice of two types of bearing bars. Square, for smoothest walking surface . . . serrated, for maximum safety under extremely hazardous conditions.

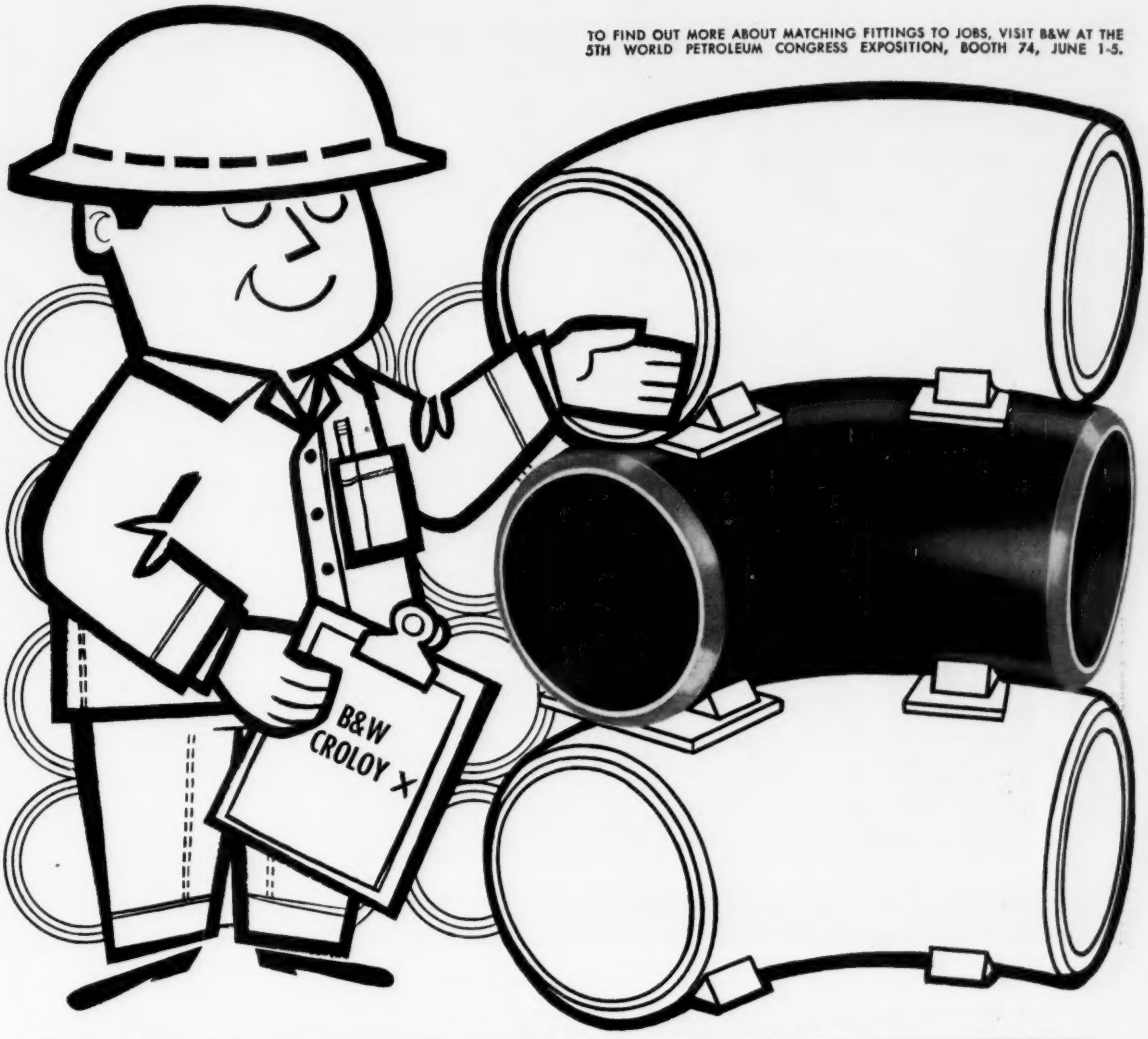
Self-cleaning—Electroforged construction leaves no sharp angles to clog with dirt or grease. Being open, rain water usually provides all the cleaning necessary. Maximum open area allows light for working beneath floor.

Blaw-Knox has the grating and treads best suited to your needs. For information on how to specify and order, send for your copy of Blaw-Knox Bulletin number 2527.

BLAW-KNOX

BLAW-KNOX COMPANY
Equipment Division
Dept. C, Pittsburgh 38, Pennsylvania

TO FIND OUT MORE ABOUT MATCHING FITTINGS TO JOBS, VISIT B&W AT THE 5TH WORLD PETROLEUM CONGRESS EXPOSITION, BOOTH 74, JUNE 1-5.



B&W JOB-MATCHED ALLOY FITTINGS

reduce your alloy piping problems

- You can have rapid installation and eliminate production holdups because B&W alloy steel welding fittings are dimensionally accurate and fit up fast for easy positive welding
- You get long service life because you can match the correct alloy steel to the application
- And, you get the advantage of B&W's experience in the manufacture and application of alloy steel tubular products which backs up every B&W Alloy Welding Fitting

When writing the specifications on an alloy piping job — specify B&W Job-Matched Welding Fittings. They are available in a complete range of types and sizes in carbon steel and, of course, the famous B&W CROLOYS. Call your local B&W District Sales Office or any qualified welding fittings distributor. For technical data on B&W Fittings write for the new 12-page Bulletin FB-78. The Babcock & Wilcox Company, Tubular Products Division, Fittings Department, 3839 W. Burnham Street, Milwaukee 46, Wisconsin.

B&W

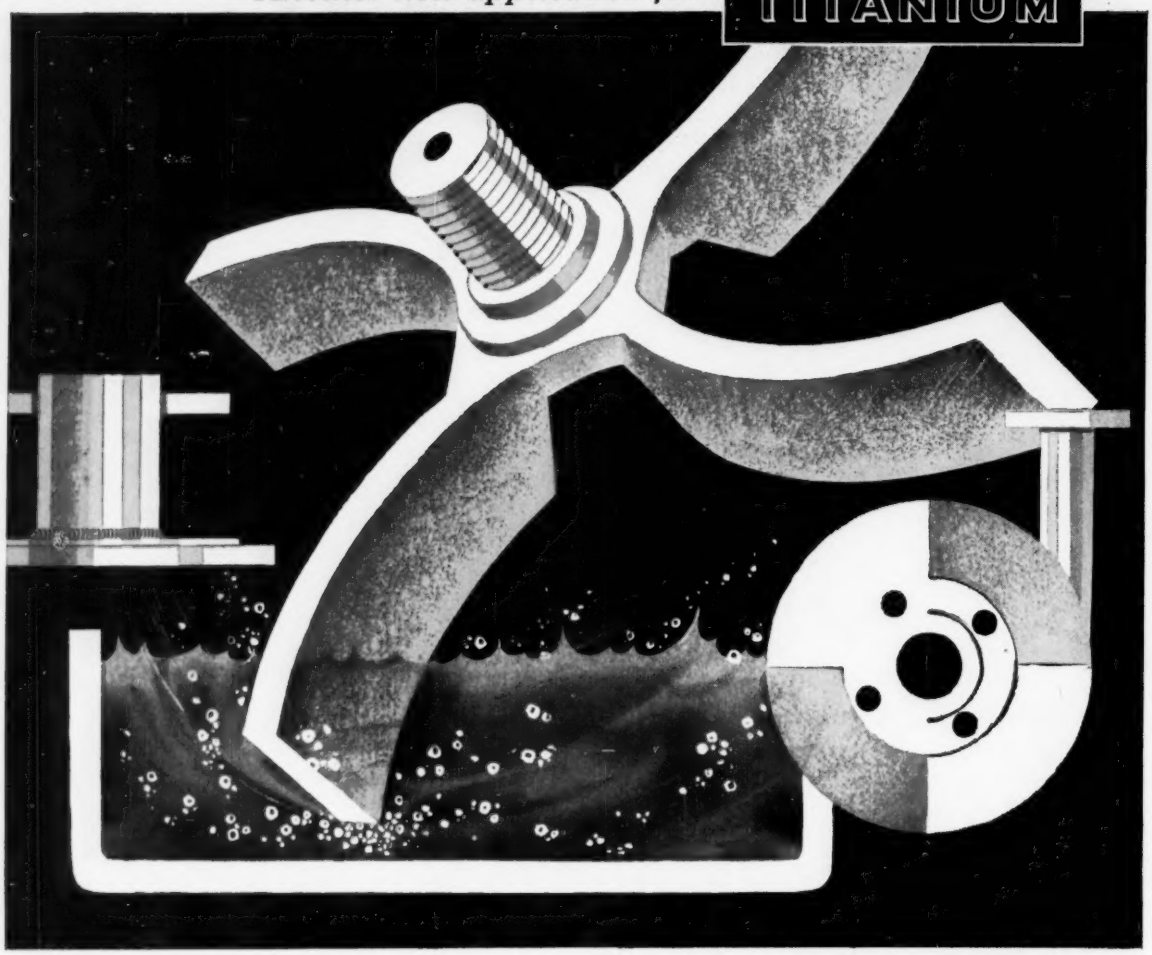
THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION, FITTINGS DEPARTMENT

TA-9024-WF2

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

Another new application for **TITANIUM**



PUMPING HIGHLY CORROSIVE SOLUTIONS?

Titanium provides the answer in "Durcopumps"®

The Duriron Co., Inc., designers and manufacturers of equipment for corrosive service, is among the first to take advantage of titanium's outstanding corrosion resistance in pumps and pump parts.

Working closely with Duriron engineers, Mallory-Sharon helped develop welding and forming techniques for production of a fabricated titanium centrifugal pump. Durcopumps, *with all wet end parts fabricated of Mallory-Sharon commercially pure titanium*, are being produced to order, for pumping hot nitric acids, hot chlorides, etc.

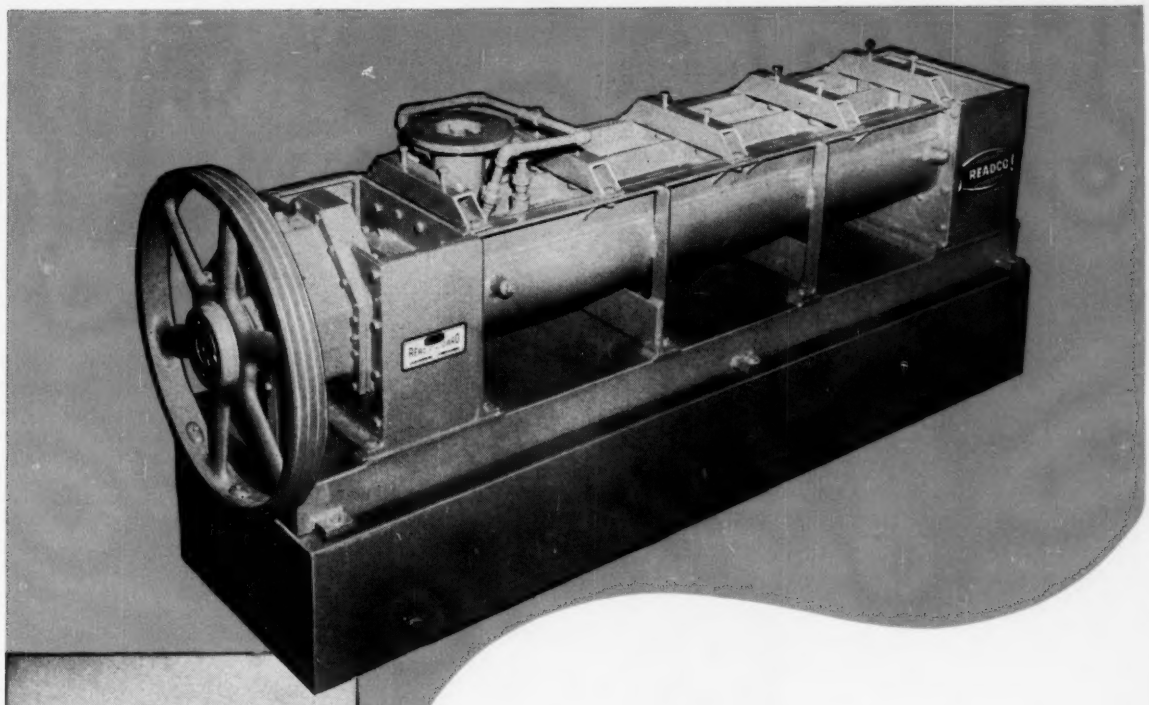
As proof of titanium's superior corrosion resistance, operation of a million-dollar chemical plant was being held up for lack of a suitable pump to handle boiling 65% nitric acid. Cost of downtime was $1,000 per day. Two titanium centrifugal pumps were installed in the line. To date, they have given *over 12 months' service*—compared to less than 30 days' service for nickel-base alloys previously used.

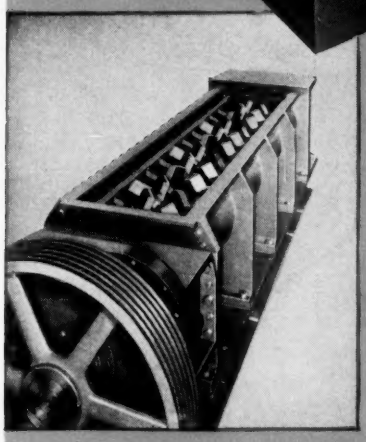
Mallory-Sharon engineers are ready to work with *you* in applying titanium. Write for Technical Data Sheet on *"Titanium Pumps for Chemical Service"*. Please address: Commercial Market Development, Dept. B, Mallory-Sharon Metals Corporation, Niles, Ohio.

MALLORY MS **SHARON**

MALLORY-SHARON METALS CORPORATION · NILES, OHIO

Integrated producer of Titanium · Zirconium · Special Metals





READCO

3 CUBIC FEET A MINUTE

Perfectly Mixed!

Speed production, lower costs...automatically with Readco Continuous Double Arm Mixers

You can step up production and reduce costs of processing dense and viscous materials with this rugged Readco mixer. Built for continuous, automatic operation, it will turn out ½ to 3 cubic feet per minute . . . in a completely homogeneous mix.

Overlapping action of mixing paddles fully disperses ingredients while moving them along to discharge. Temperature controlling jackets for heating and cooling are standard equipment.

For further information on Readco mixing equipment, see Chemical Engineering Catalog pages 1567 to 1574D.

Whatever the mixing job: a READCO mixer!

READ STANDARD
York, Pennsylvania
A Division of
Capitol Products Corporation

RING OF STEEL

Defies Pressure Times Ten

The Flexitallic gasket in the bonnet joint of Hancock Steel Gate Valves cannot blow out even if pressures exceed ten times the rating of the valve. Valve maintenance and equipment down-time are greatly reduced. Made of a spiral-wound ribbon of stainless steel with asbestos filler, the gasket has spring-like compressibility – cannot be flattened.

Only the specially-designed Hancock bonnet joint with built-in compression limit can make full use of the positive sealing power of this ring of steel. Such advanced valve engineering is one example of total Hancock quality that assures trouble-free performance. Your nearby industrial supply distributor will gladly explain every economy feature of Hancock Steel Gate Valves. Phone him today.

Hancock 800# Steel Gate Valve, Type 950. Sizes: ¼" thru 2".

MAXWELL MANNING M&M MOORE INC. TRADE MARK

HANCOCK STEEL VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Watertown, Massachusetts
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

SPECIAL FITTINGS Need *NOT* Delay You

Entire interior and exterior surfaces of special stainless elbows for nuclear power plant are inspected with dye penetrant in search of microscopic surface imperfections. Elbows are 16" O.D. with 102° included angle and long tangent on one end.

Midwest Can Make *and* Deliver

An exclusive and flexible manufacturing process enables us to make welding fittings of any material available in plate that can be worked and welded. As plate is more readily available than pipe, in special materials and thicknesses, deliveries are much better.

Elbows with special included angles, special tangents, special wall thicknesses and of special materials are easily and promptly made. Closer tolerances are inherent in the Midwest process. Quality control always exceeds code requirements . . . can be as comprehensive as you need.

Whether or not you use specials, Midwest Welding Fittings will do a better job for you. Consult your distributor, or write us for new Bulletin 5801.

MIDWEST PIPING COMPANY, INC.

Main Office: St. Louis 3, Mo. (P. O. Box 433)

PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

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Los Angeles 33—520 Anderson St. • Miami 34—2103 Le Jeune Rd.
New York 7—50 Church St. • Pittsburgh 19, Pa.—437 Grant St.
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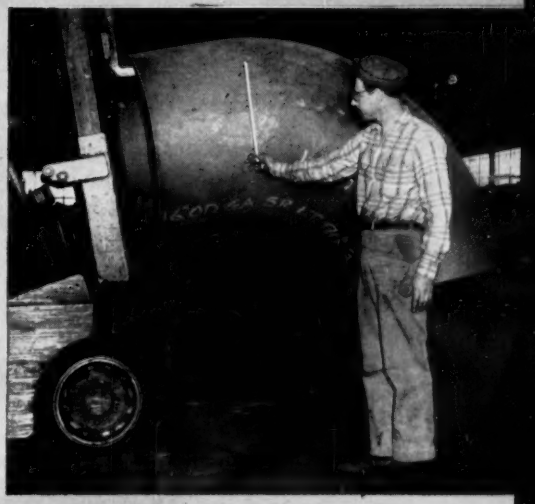
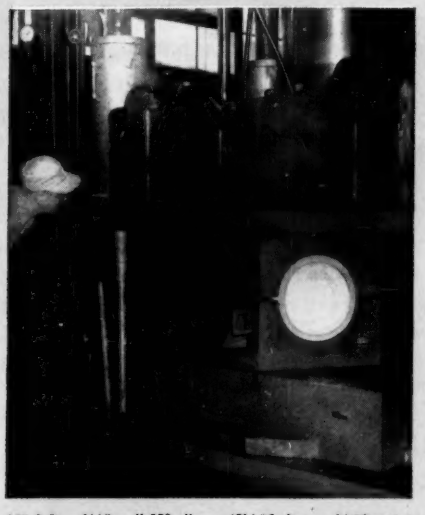
Tulsa—1640 E. 21st St.

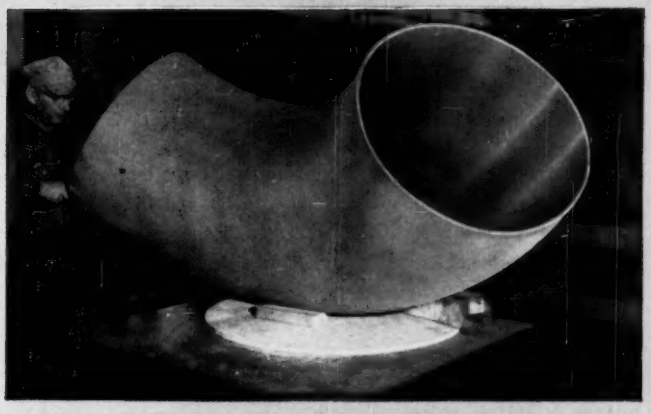
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES



Note the exceptionally long tangent on one end of this 36" O.D. 90° short radius elbow made of special carbon steel. Similar tangent could have been provided on other end if required.



18" O.D. x 1¼" wall 90° elbows (2¼% chrome ½% moly) being sized in compression by totally enclosing dies. The exceptional dimensional accuracy that results is possible only with the Midwest process.



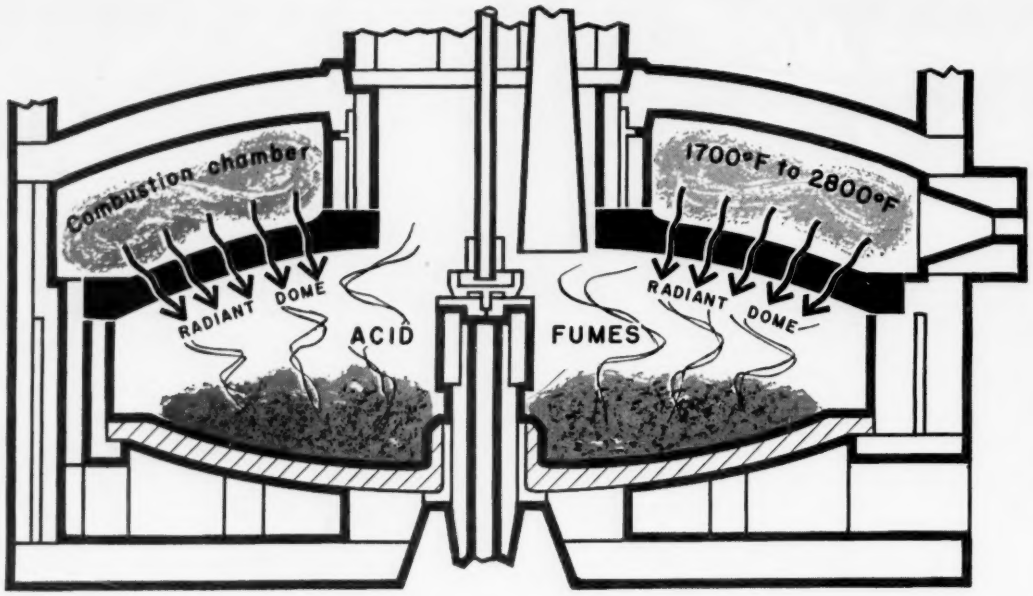
Interior surface of 30" O.D. stainless steel welding elbow for liquid sodium nuclear system required a finish of 125 micro-inches or better.

8060

MIDWEST WELDING FITTINGS

IMPROVE PIPING DESIGN and REDUCE COSTS

It took one of Carborundum's refractories to solve this problem:



Delivers heat fast . . . resists corrosion . . . and stands stresses over a wide temperature range

A radiant dome is used for indirect heating in the Mannheim furnace sketched above. Sulfuric acid and salt cake are fed into an externally heated chamber to produce HCl gas. Temperatures above the radiant dome range from 1700–2800 F.

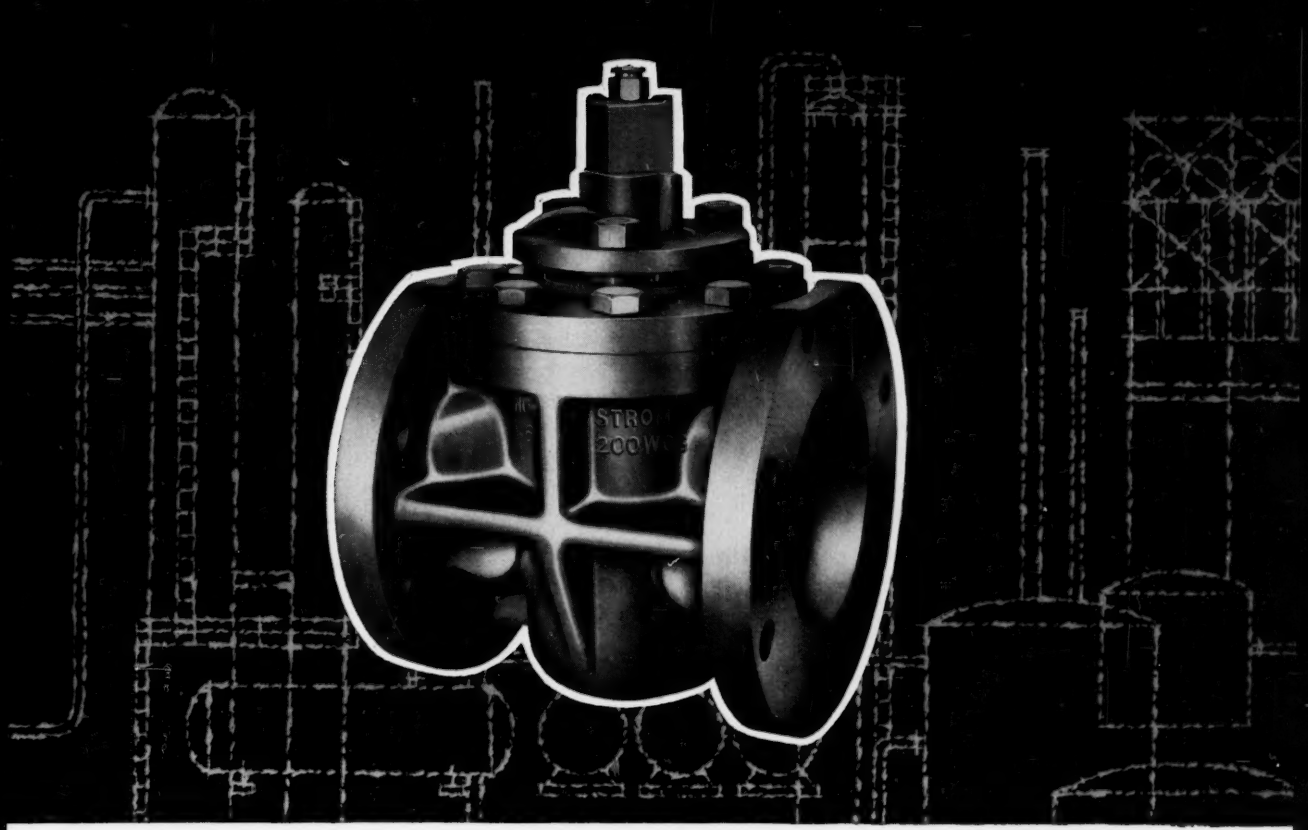
The problem here is complete separation of the highly corrosive charge from the heat source by a material that can live with these destructive conditions, yet, will transmit heat very rapidly. The problem is intensified because the dome may be as large as 20′ in diameter, hence must be constructed of a material with adequate strength even at extreme temperatures.

One of Carborundum's Refractories—CARBOFRAX® silicon carbide—meets all these conditions. It has exceptionally high heat conductivity (11 times better than fireclay) and is inert to most acids. Its load bearing strength at high temperatures —300 psi at 2750 F without crushing — also enables the CARBOFRAX shapes to withstand the tremendous structural stresses involved.

If you have a problem like this that even the best of standard refractories or metals won't handle, consider Carborundum's Refractories. There is a wide range of products, each with a *combination* of properties seldom found in other materials of construction.

Write today for your free copy of "Super Refractories by Carborundum." The address: Dept. H-59, Refractories Division, Perth Amboy, New Jersey.

CARBORUNDUM
Registered Trade Mark



NEW! ROCKWELL-Nordstrom VALVES

WITH SPECIAL CORROSION RESISTANT COATINGS

Here are two important new additions to the Rockwell-Nordstrom line of corrosion resisting lubricated plug valves. Rockwell-Nordstrom valves are now available with the following special coatings to make them fully corrosion resistant in many refining and chemical plant services:

KANIGEN COATING(1): a chemical method of applying a 90%-92% nickel—8%-10% phosphorous coating to iron or steel valves. The internal-external coating of Kanigen assures the corrosion resistance of nickel and stainless steel on most corrosive services.

K-51 COATING(2): a halogenated ether polymer applied by the patented Whirlclad Process(3) on inner and outer surfaces of standard valves. With K-51 coating, iron and steel valves become exceptionally resistant to attack by most acids, caustics, brines, inorganic solvents and many organic solvents.

Send for complete details on how the new Rockwell-Nordstrom coated valves can help you solve your corrosive flow control problems. Get the facts, too, on special weld-coat "*hard faced*" valves and more than 300 patterns in special metals such as bronze, nickel, Monel, Ni-Resist, Stainless and many others.

Rockwell Manufacturing Co., Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Ltd.

SEND FOR COMPLETE DETAILS

(1) Applied by General American Transportation Corporation.

(2) (3) K-51 Penton and Whirlclad are patented by National Polymer, Inc.

ROCKWELL-Nordstrom VALVES

another fine product by

ROCKWELL

Rockwell Manufacturing Company

Pittsburgh 8, Pa.

_____Please send complete details on new coated valves.

_____Please send complete details on all Rockwell-Nordstrom valves for corrosive services.

_____Please have your Rockwell field engineer call.

Name:_____ Title:_____

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SPROUT-WALDRON Pointers

for Mixing and Blending • Size Reduction
Size Classification • Bulk Materials Handling • Pelleting and Densifying

Published in the interest of better processing by Sprout, Waldron & Co., Inc., Muncy, Penna.

Production and Quality up with Single Runner Attrition Mill

Fiberizing asbestos by means of Sprout-Waldron single runner attrition mill speeds production, ups quality, cuts waste.

The use of a 36″ swinghead, single runner attrition mill at The Garlock Packing Company, Palmyra, New York is reported to have increased production, lowered costs and improved quality.

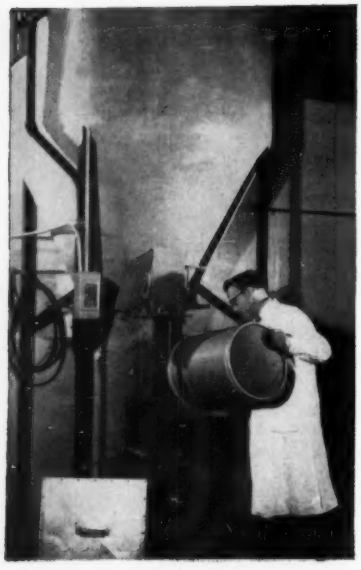
The asbestos fiber at The Garlock Packing Company is used in the production of textile yarns and cloth which become base materials for mechanical packings, gaskets and compressed asbestos sheet. Fiberizing equipment previously used consisted of a roll crusher, a vertical opener, and a willow used in conjunction with a ceiling condenser. The Sprout-Waldron 36″ swinghead single runner attrition mill which replaces these units is simple and compact by comparison.

The following advantages have been noted:

1. The fiberizing and blending of milled asbestos have been improved.
2. Production rate has been increased.
3. Separation of short fractions of asbestos has been reduced, thus minimizing waste.
4. Simple adjustments on the attrition mill plates permits flexibility, whereas fiberization with the old equipment could only be controlled by the rate of feed.
5. Semi-crude blue asbestos is fiberized in one pass through the attrition mill. Previous methods required two passes.

SW

POLYCARBONATE RESIN BLENDED IN STAINLESS STEEL MIXER



Stainless steel jacketed vertical mixer being fed through table high hopper at General Electric Company's Chemical Development Department in Pittsfield, Massachusetts.

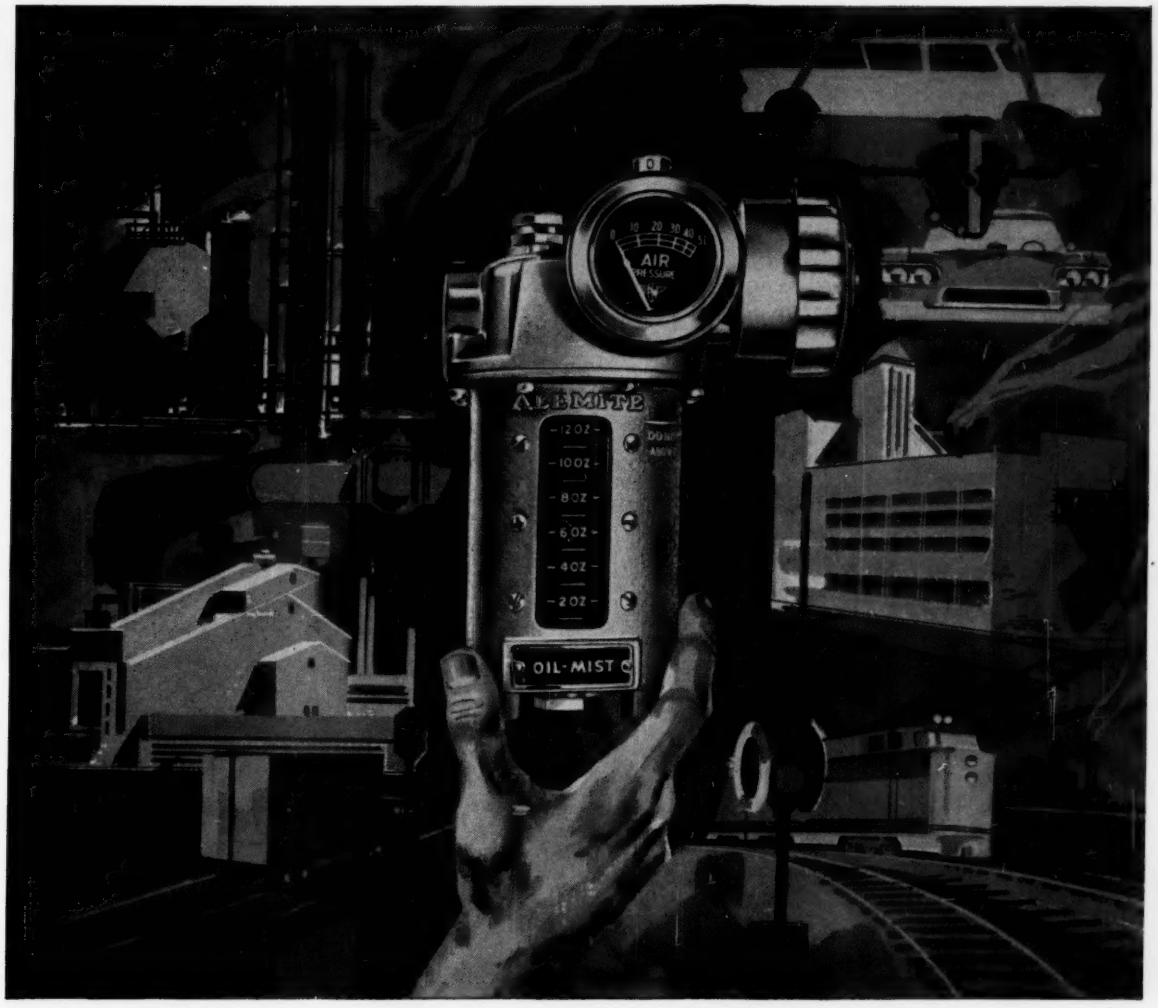
Uniform blending of polycarbonate resin at the General Electric Company's Chemical Development Department plant in Pittsfield, Mass., is being accomplished in a special stainless steel 50 cubic foot vertical mixer. The 10′ 10⅝″ high, 60″ diameter vertical mixer is jacketed for 14.7 psig steam pressure.

The product to be blended is trade named, "Lexan". It is a special polycarbonate resin molding compound developed by the General Electrical Company to provide unusual toughness and heat stability. The mixer's job is to blend this resin while in ⅛″ chopped rod pellet form just prior to packaging.

In designing the mixer, four major problems had to be overcome. The material had to be kept warm during processing; floor space was at a premium; excessive attrition had to be avoided; and it was desired to feed the mixer from the ground floor.

The use of a steam jacket on the mixer solved the problem of keeping the material warm during processing. The selection of the Sprout-Waldron vertical mixer design took care of the floor space requirements. This 50 cubic foot capacity mixer, including the table height loading unit requires less than 15 square feet of space.

Tests were conducted to find the optimum motor speed to assure thorough blending with a minimum of attrition . . . and ground floor feeding was achieved by the design of the mixer which receives its support from four vertical legs attached to the sides of the cylinder. The hopper is centered just about table top level for convenient feeding. The forced feed-in screw and elevating section below the mixing cone offers maximum efficiency



WHY 500 BLUE CHIP COMPANIES LUBRICATE COSTLY MACHINERY WITH ALEMITE OIL-MIST SYSTEMS

An Alemite Oil-Mist Lubrication System provides safe, foolproof, automatic lubrication . . . increases machine output . . . reduces lubrication costs.

Designed for a wide range of applications. Oil-Mist provides constant, uniform lubrication of many sizes and types of bearings, from small sewing machine bearings to large steel mill back-up roll bearings or work roll bearings. Open type and enclosed gear trains and chain drives are lubricated by Oil-Mist when leakage problems exist. An Oil-Mist System is also ideal for lubricating slides, ways and cams, where a minimum of continuous lubrication is required.

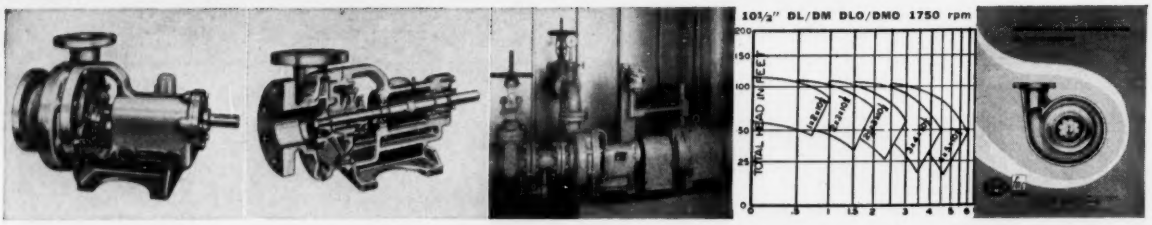
Used in both large and small plants. Alemite Oil-Mist Systems are now operating in hundreds of plants . . . reducing operating temperatures and bearing wear . . . eliminating housekeeping problems and contamination due to over-lubrication . . . reducing man-hours and down-time. Check *your* plant. Perhaps you, too, can benefit from the many important advantages of a modern Oil-Mist System.

Cut costs . . . reduce man-hours and machine down-time . . . extend bearing life . . . increase production . . . with a modern Alemite Oil-Mist Lubrication System

Write today for free Oil-Mist catalog!
Dept. J-59, 1850 Diversey Parkway, Chicago 14, Illinois

Symbol of SW Excellence

ALEMITE DIVISION
STEWART-WARNER CORPORATION



BECAUSE... PEERLESS CHEMICAL PUMPS:

MEET critical standards of construction, you benefit from longer pump life, less maintenance, and sharply reduced incidence of system shut down caused by pump failure. Top quality Peerless construction means a dependable, rugged pumping unit you can count on to stay on the job for years longer.

PROVIDE proved operating history, you benefit from the knowledge that you're not buying a pump in the dark. Analysis by Peerless of customer pump operating records allows continuous product improvement. Correlation of this data provides Peerless with answers to nearly all field pumping problems.

OFFER optimum performance range, you benefit from the economical performance only the exact pump for the job can give you. The Peerless process pump line of over 78 models, sizes and frames, plus thousands of combinations, assures you of pinpoint pump selection that effects direct savings in cost.

EMBODY benefits of research in all areas of design, construction, and application. Typical of the many considerations in the design and manufacture of a Peerless pump is the ascertaining of effects of radial loads. **An interesting 8 page booklet discussing this phase of pump design is available to you upon request.**

Engineers and Pump buyers say:

"PEERLESS PUMPS IT BEST!"

...buy and apply PEERLESS PUMPS

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump Division

Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

Offices: New York; Atlanta; St. Louis; Phoenix; San Francisco; Chicago; Fresno; Los Angeles; Plainview and Lubbock, Texas; Albuquerque.

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DOW | **SARAN LINED PIPE**

After eight years carrying lithium chloride brine . . .

no corrosion in SARAN Lined Pipe

When pipe must carry extremely corrosive lithium chloride brine . . . when floor-level installation freely exposes it to danger of accidental damage from trucks and tools . . . doubly protective SARAN Lined Pipe can mean dependable, low-maintenance operation for many years.

Lithium Corporation of America's Minneapolis, Minnesota, plant produces pure lithium metal as well as various lithium salts. In the production of lithium chloride, SARAN Lined Pipe is used to carry LiCl brine to drying equipment for the removal of water. This brine is extremely corrosive and will quickly eat through steel pipe should a crack develop in the lining. Other SARAN Lined Pipe carries suspensions of lithium fluoride and hydrofluoric acid, a combination which will attack and destroy even glass. Because of its strength and extreme corrosion resistance, there's never been a failure in the SARAN Lined Pipe.

SARAN Lined Pipe at this plant is installed close to floor level in some working areas, constantly exposed to the danger of accidental damage from trucks and tools. Lithium's engineers stated, "SARAN Lined Pipe provides protection from outside damage and from corrosion by the solutions carried. In eight years of pumping LiCl brine through SARAN Lined Pipe at 30 to 50 psi, there's never been a breakdown, and very little maintenance was required."

SARAN Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200° F. They can be cut, fitted and modified easily in the field, without special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 2281AK5-18.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

you can eliminate shaky temperature readings

Even when the equipment is vibrating so that its outlines are blurred, you can take a quick, accurate temperature reading from an RMC thermometer.

Resistance to vibration is built into every RMC thermometer. Our engineers have done it so thoroughly that if there is any pointer oscillation it is not apparent. You always *know* what the temperature is within ½ to 1% accuracy to which the thermometers are made.

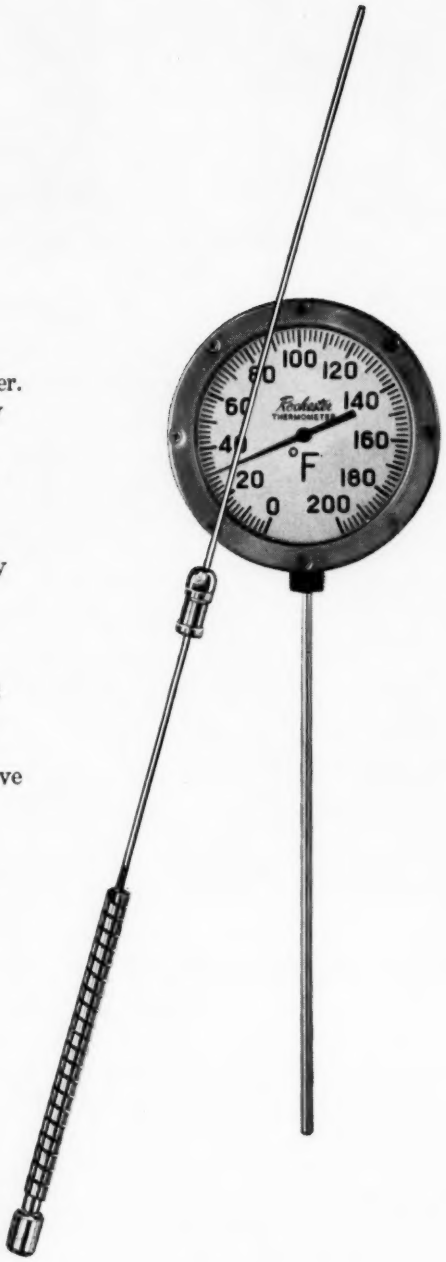
The engineering department's dislike for vibration goes beyond the desire to eliminate the annoyance and inaccuracy of a shaky needle. Vibration, unless it is controlled, can cause the bimetallic heat-sensing element to unwind partially and throw the instrument out of calibration.

None of these things can happen to you when you use RMC thermometers, because they are doubly dampened . . . first, by treatment with silicone dampening fluids . . . secondly, by the use of a special dampening bearing, just above the bimetallic element to dampen movement of the shaft as well as to maintain its alignment within the tube.

This is just one of the exclusive features we put into RMC thermometers to make sure that they will serve you accurately and long. When you look at a thermometer you want to *know* it's right . . . and we want you to know that if it's an RMC you can be sure.

Accuracy is a lot of little things—as well as a painstaking attention to detail, but it's our business.

If you have a temperature, liquid level, or pressure reading problem, why not turn it over to our engineers. Just wire, write or phone.



Ralph Foster

RMC

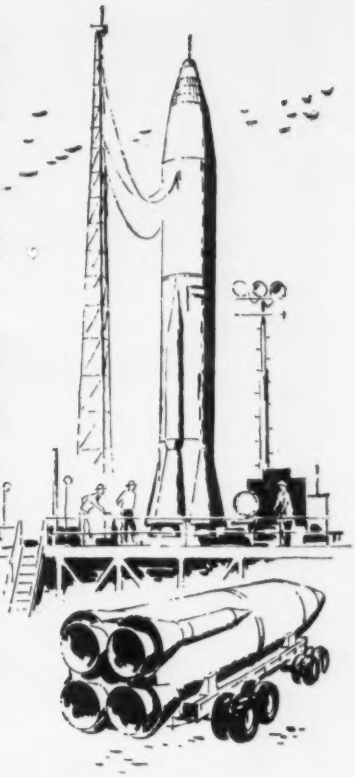
ROCHESTER MANUFACTURING CO., INC.
113 ROCKWOOD STREET • ROCHESTER 10, N. Y.

LIQUID LEVEL, TEMPERATURE AND PRESSURE INSTRUMENTS

Representatives in all Principal Cities

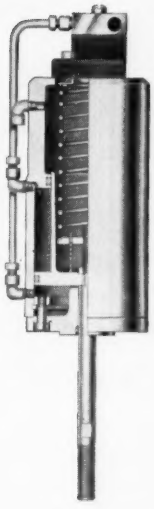
Annin OFFERS YOU MORE IN ACTUATORS

Your choice OF ADVANCED DESIGNS WITH MORE PRECISE POSITIONING AND DYNAMIC RESPONSE CHARACTERISTICS



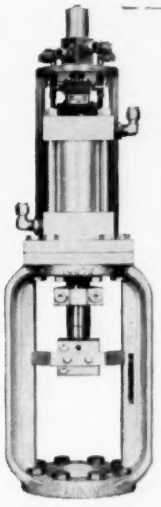
1542 & 1544 SERIES DOMOTOR POWERED ACTUATORS

Two types, "Direct Thrust" (illustrated) or "Lever" units are available for any application requiring accurate positioning in response to a pneumatic signal, such as butterfly valves, dampers, turbines and engine governors. Guaranteed positioning accuracy of better than 0.001" per inch of stroke over the complete range of piston travel is combined with a smooth operating action that provides an accurate, stable output force.



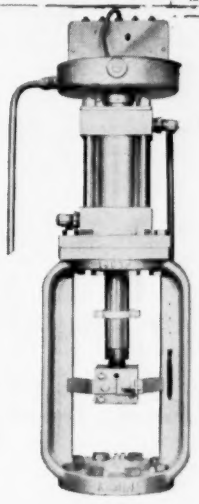
600 SERIES STROKE POSITIONING ACTUATORS

Offered primarily for the control of variable speed drives, rheostats, pumps and cams, as well as control valves, with strokes up to 6 inches and forces up to 2510 pounds of thrust. Compact and rugged, for easy mounting on existing equipment. May be operated from a standard 3-15 psi instrument signal, with a positional accuracy within 0.001" per inch of stroke.



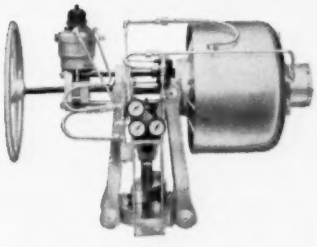
10,000 SERIES PNEUMATIC-HYDRAULIC ACTUATORS

For valves requiring strokes to 6 inches and thrusts to 100,000 lbs. Furnished on body assemblies where process conditions require very fine valve response, hi-speed and stability. Operate on 1500 psi oil supply system from any common instrument air signal.



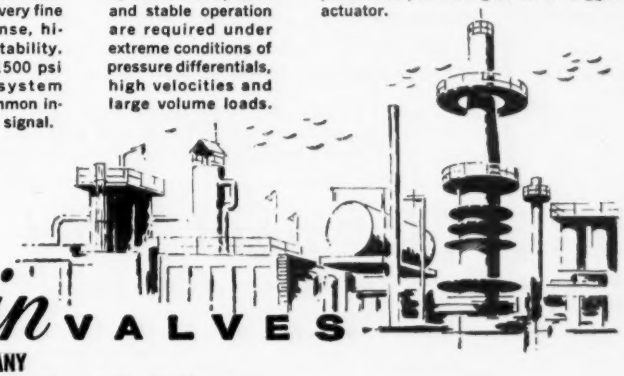
20,000 SERIES ELECTRO-HYDRAULIC ACTUATORS

Provide a means of converting an electrical signal to a powerful hydraulic positioning force, where high speed of response and stable operation are required under extreme conditions of pressure differentials, high velocities and large volume loads.



TOGGLE ACTUATORS

For process requirements where the unbalanced forces are extremely high, or where large through-puts are required. Three types are offered: pneumatic positioning, pneumatic on-off, and manual control, all embodying the toggle actuator; or a manual control arrangement can be combined with the pneumatic positioning or on-off toggle actuator.



Annin VALVES

THE ANNIN COMPANY
1040 S. Vail Avenue, Montebello, California

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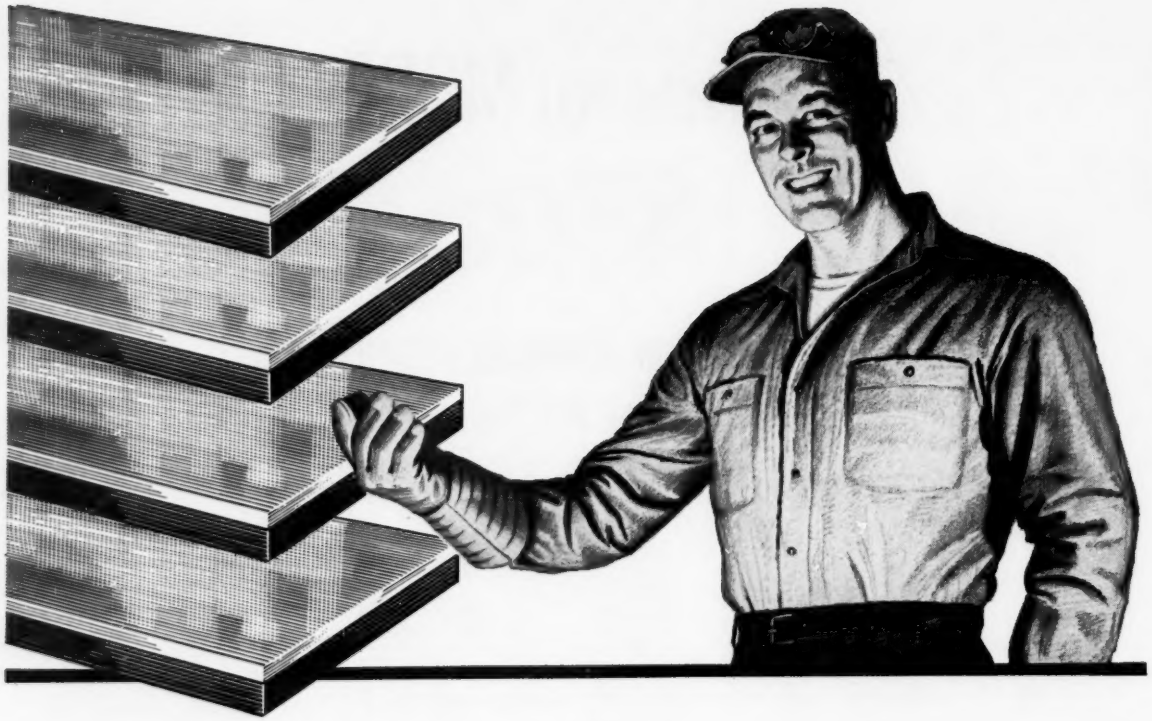

The Image of CF&I... producer of

CLAYMONT
STAINLESS-CLAD PLATE

This giant steelman symbolizes CF&I ... one of America's top-ranking primary producers of quality steel products. He reflects CF&I's pledge..."not merely to *sell* but to *serve*"... by supplying ever-improved products for industry's new and more demanding requirements. Products like CF&I-Claymont Stainless-Clad Steel Plate.

Claymont Stainless-Clad Plate...

- provides the same *protection*—against corrosion, abrasion or product contamination—as solid stainless steel, on applications where only one side of the plate is exposed to such wear factors.
- provides the *economy* of a carbon or alloy steel backing plate.
- is supplied in AISI stainless specifications 304, 304L, 316, 316L, 316Cb, 321, 347, 405, 410, 430 and ASTM specifications A-263 and A-264, plus others to meet special requirements.

The stainless cladding... from 5% to 50% of total plate thickness... is inseparably bonded to the backing plate.

Get full details from the CF&I sales office nearest you.

CF&I-CLAYMONT PRODUCTS: Carbon Steel Plates · Alloy Steel Plates · CF&I Lectro-Clad Nickel Plated Steel Plates · Clay-Loy High Strength Low Alloy Steel Plates · Flanged and Dished Heads · Manhole Fittings and Covers · Fabricated Steel Plate Products Large Diameter API Pipe

Claymont Steel Products

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6921

VACUUM KETTLE
FLASH DRIER
DISTILLATION COLUMN
FORE PUMP
VACUUM ACCUMULATOR
FREEZE DRIER
EVAPORATOR
MULTI-NOZZLE WATER JET EXHAUSTER (First Stage)
STEAM JET VACUUM EXHAUSTER (Third Stage)
STEAM JET VACUUM EXHAUSTER (Second Stage)
Size No. 4, Fig. 529. Three-Stage Unit measures about 6 ft. in height by 4 ft. max. in depth.

PRODUCE HIGH VACUUM QUICKLY & ECONOMICALLY

with this "Packaged" Hydro-Steam Unit

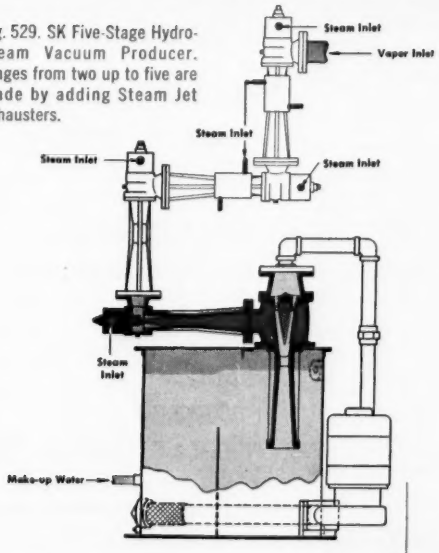

Fig. 529. SK Five-Stage Hydro-Steam Vacuum Producer. Stages from two up to five are made by adding Steam Jet Exhausters.

The unit shown is a "packaged" vacuum producer designed to operate at ground level. Using plant steam and make-up water, it will produce the low suction pressures required for many operations in chemical, food, and petroleum processing plants.

These units are made in a range of sizes in single-stage, two, three, four, and five-stage types. Depending upon size and type, units in this line will provide suction pressures ranging from atmosphere to 1.5 in. Hg abs (single-stage) up to 0.25 mm Hg abs to 25 microns Hg abs (five-stage).

SK "Packaged" Vacuum Producers offer specific, worthwhile advantages. They are simple in construction, are self-contained, compact, require little head room or floor space, are easily installed. Unlike mechanical vacuum producers, contamination presents no problems. They are operated easily, produce vacuum quickly, are economic, can be used intermittently or continuously as desired.

New Bulletin 5H-HS gives complete details on application, construction, operation including suction pressures provided and data on steam consumption and make-up water required. Send for a copy.

JET APPARATUS: Ask for Condensed Bulletin J-1.
ROTAMETERS & FLOW INDICATORS: Ask for Condensed Bulletin M-1.
VALVES: Ask for Condensed Bulletin V-1.
HEAT TRANSFER APPARATUS: Ask for Condensed Bulletin HT-1.
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This deaerator is designed for removal of all minerals and silica from boiler make-up water at the nation's largest ion-exchange processing installation . . . and protected *permanently* against corrosion, contamination and abrasion with Manhattan Rubber Lining! Giant 52,000 gallon capacity is no problem for R/M lining specialists. If a unit can be shipped, it can be handled at a Raybestos-Manhattan rubber lining plant . . . equipment too large to ship is field lined and vulcanized by experienced and supervised crews.

The most modern facilities available today—*plus* experience dating back to the first tank lined in this country—are ready to assure the best possible lining job for your equipment at Raybestos-Manhattan. Manhattan Acid-Proof Rubber Linings are made from thick, multiple calendered sheets of natural or synthetic rubber for utmost protection and durability. Lining expands and contracts with metal under temperature change . . . won't harden or crack. Manhattan Rubber Lining is bonded to metal so securely tests have proved they can't be separated! Resistance to most acids and alkalis is as positive as advanced technology can provide. To make certain your equipment lining is flawless *and* permanent . . . every Raybestos-Manhattan Lined Tank is tested under high voltage.

Be sure your costly equipment and solutions get the *complete* protection your investment demands . . . discuss your lining requirements with an R/M representative nearest you.

- Multiple Calendered Sheets
- Permanent Protection Against Corrosion, Contamination
- Permanent Rubber-to-Metal Bond
- Resistant to Acids, Alkalis, Abrasion, Temperature
- Largest Facilities . . . Longest Experience
- Rubber Lining Plants at Passaic, N.J., North Charleston, S.C.

RM-904

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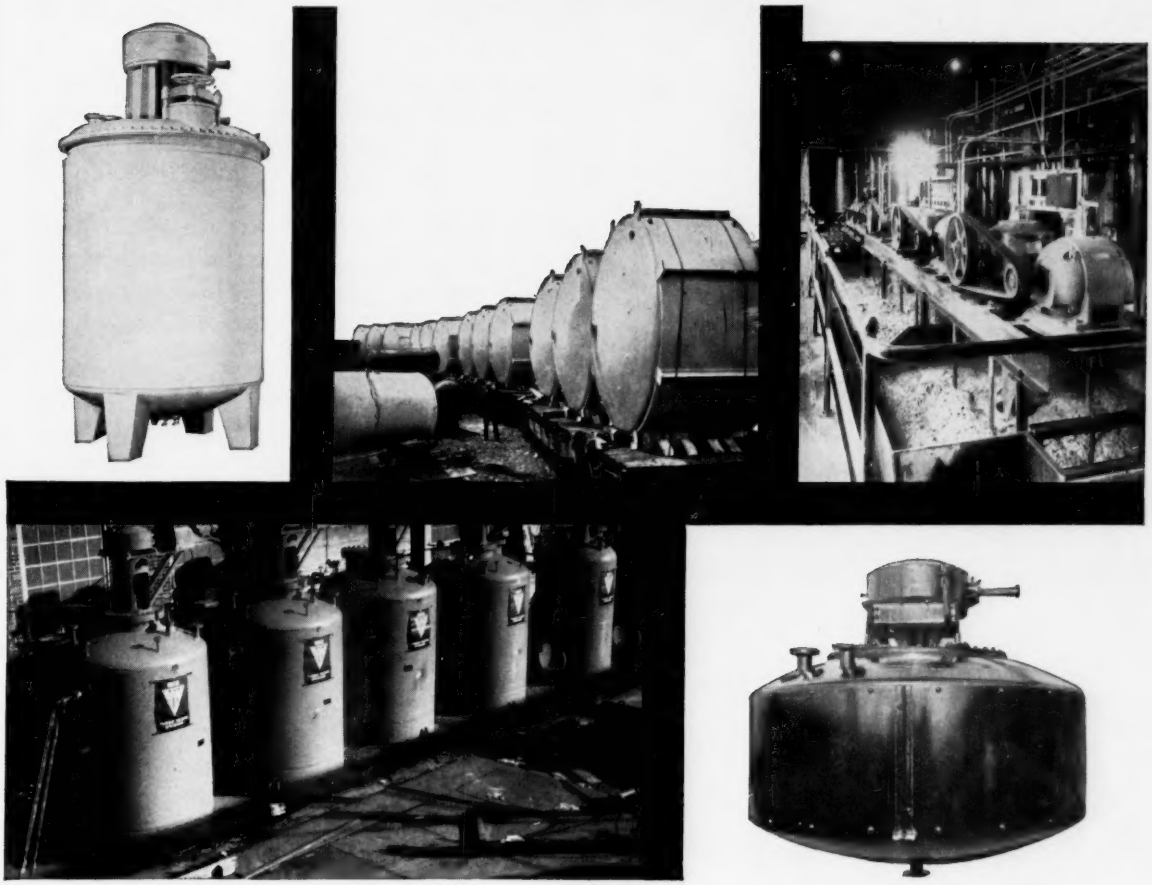

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No middleman need enter the picture when you look to General American for your mixing requirements.

General American's Turbo-Mixer Division not only supplies you with the most effective and economical mixing equipment, but with tank and supporting structures, drive and special accessories.

This "one package responsibility" saves you money, assures perfect harmony of all components in your production line, and long, trouble-free performance.

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SLURRIES... and 7 reasons why SHARPLES SUPER-D-CANTERS are preferred in the PROCESS INDUSTRIES...

① **SIX SIZES . . . . . WIDEST CAPACITY RANGE**

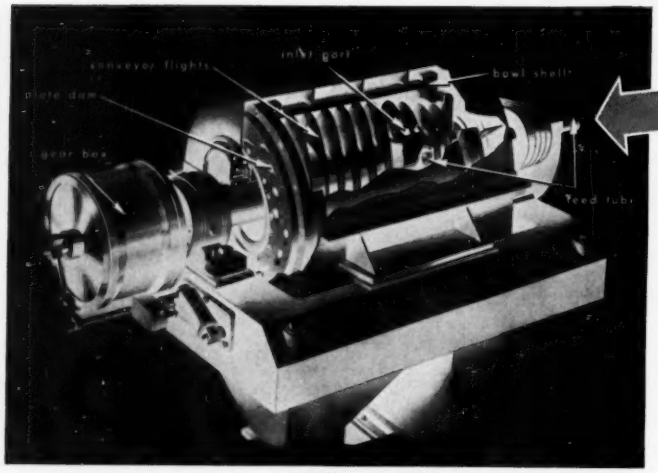
Solids Handling Capacity from a few lbs./hour to 3,000 lbs. or more lbs./hour in horizontal Super-D-Canters—up to 10-15 tons/hour in vertical Super-D-Canters.

Liquid Handling Capacity from a few gal./hour to 7,000 or more gal./hour in horizontal Super-D-Canters—up to several hundred gal./minute in vertical Super-D-Canters.

② **SLURRIES OF ½%** or less to 50% or more solids concentration can be clarified or dewatered continuously with high efficiency. Moistures as low as 1% can be obtained depending upon characteristics of the feed slurry.

③ **AMORPHOUS and CRYSTALLINE SOLIDS** in the size range from a few microns up to relatively large particles are being processed efficiently.

④ **BROAD RANGE OF MATERIALS HANDLED**—from basic inorganic and organic chemicals such as alkali, reaction chemicals and polymerized plastics, to fruit and vegetable juices, edible and inedible tallow and lard, to high energy fuel components.



Four Models of horizontal Super-D-Canter and 2 vertical Models to continuously remove solids from slurries and suspensions; recover, dewater and wash fine crystals and other solids; and clarify solids suspended in liquids.

Clarified liquid

Continuous solids discharge

⑤ **MODELS FOR PRESSURE OPERATION** to 150 psi, as required.

⑥ **HIGH CENTRIFUGAL FORCE** (to 3200 x gravity) effects greater separating capacity in a given area than is possible with lower centrifugal force.

⑦ **TESTS, PILOT PLANT OPERATIONS,** and small production on the P-600 Super-D-Canter—performance can be scaled up directly to the larger models.

Many hundreds of Super-D-Canters in service are proving daily how Sharples can help you make more profits from your slurries. Sharples trial, test, and laboratory facilities are unequalled for solving your problems.

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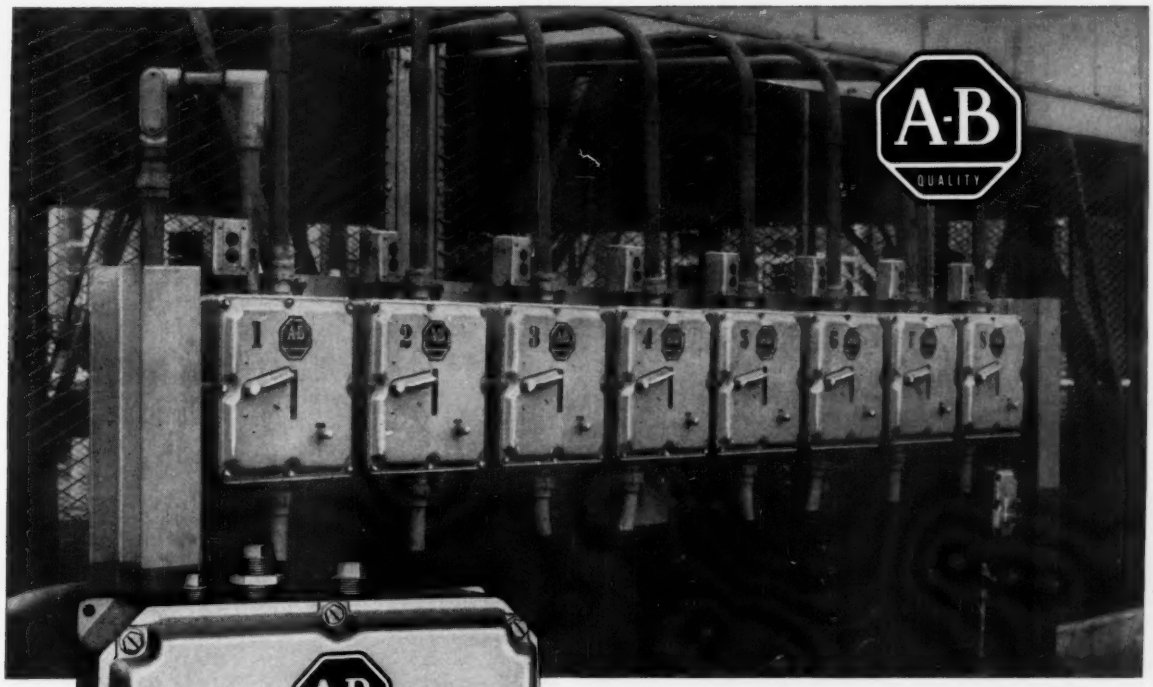
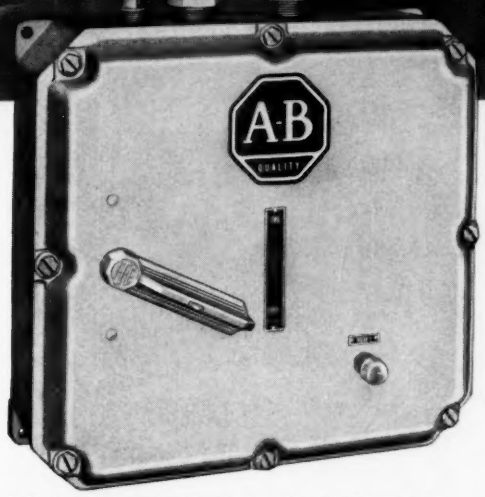
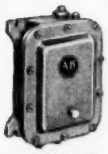




Bulletin 713 Combination Starter with circuit breaker in NEMA Type 9 enclosure for hazardous dust locations.



NEMA 7
For Hazardous Gas Locations

NEMA 4
Watertight Weatherproof

NEMA 8
For Corrosive Hazardous Gas

NEMA 11
Corrosion-proof

Round-the-clock safety . . . and reliability . . . without costly maintenance

When hazardous locations require starters in explosion-proof enclosures, it usually means costly maintenance. But *not* when you use A-B starters, because you eliminate the expense of removing and replacing bolted covers for "regular" inspection! In all A-B starters there is only ONE moving part. This is your assurance of *millions* of trouble free operations. There are no bearings to stick . . . no flexible jumpers to break. And the double break, silver alloy contacts never need servicing —they remain in perfect operating condition until completely worn away. The permanently accurate thermal overload relays are another "plus" feature. Insist on Allen-Bradley controls . . . and save on maintenance throughout the years.

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Quality Motor Control

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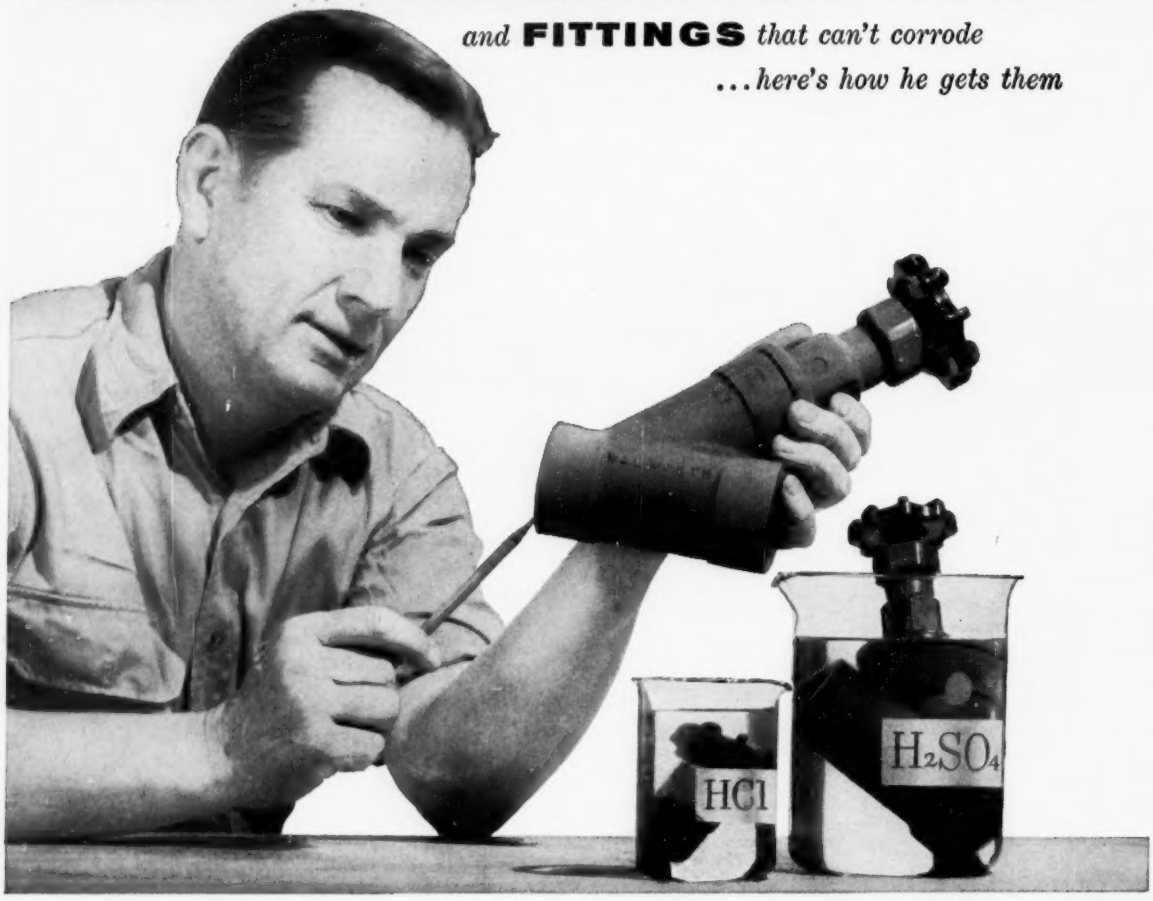
the **WALWORTH CUSTOMER** *wants* **PLASTIC VALVES** *and* **FITTINGS** *that can't corrode ...here's how he gets them*



When the Walworth Customer is faced with the control of corrosive fluids, he looks at dozens of plastic valves and checks them for himself. He demands answers to questions like these: Can this valve corrode? Is it toxic? Is it non-aging? In Walworth PVC Valves and Fittings, the Walworth Customer finds his answers. Not only is PVC nontoxic and non-aging, – it *can't* corrode. *All* parts are made of plastic. Valves and fittings have high burst strength. Given those facts the Walworth Customer buys.

That may be the way you like to buy valves, too. If you insist on knowing about materials, workmanship and high quality, we'd like you for a Walworth Customer, too. For the newest literature on the complete line of PVC Valves and Fittings, get in touch with your Walworth Distributor.

Or write **WALWORTH** *750 Third Avenue, New York 17, N. Y.*

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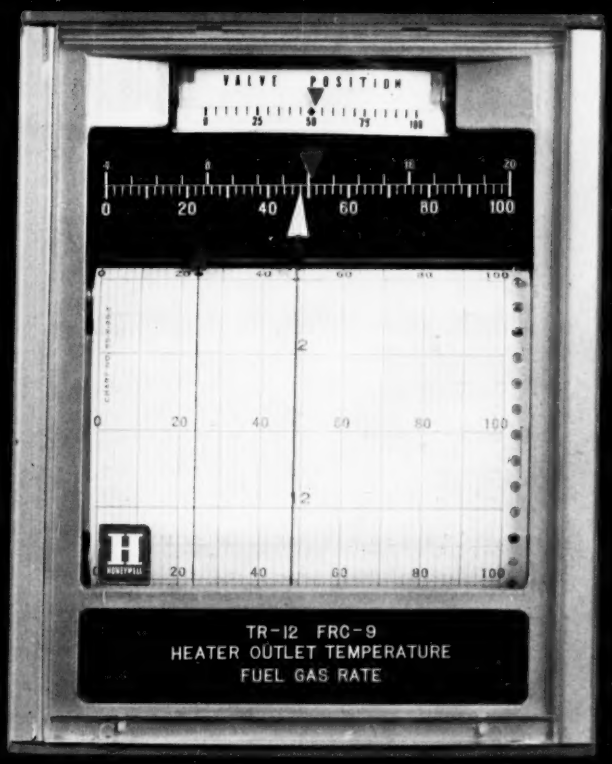
Here it is!

Honeywell's new *ElectriK Tel-O-Set** system

...the only true two-wire system for electric process control!



No line power connections in the field. The *ElectriK Tel-O-Set* system requires no external power at any field-mounted device and uses only two wires between it and the control room. These two wires form a series circuit that carries the measurement or control signal as well as the system's power. The only line power connection is made at the receiver.

Two-wire transmission sharply reduces installation costs. Add this to the fact that the *ElectriK Tel-O-Set* system's d-c transmission eliminates the need for shielding the wires, and you have the simplest, most economical installation possible.

*Trade name, Minneapolis-Honeywell Regulator Company

H HONEYWELL

COMPARE *ElectriK Tel-O-Set* WITH ANY OTHER ELECTRIC CONTROL SYSTEM!

Here it is!

the new *ElectriK Tel-O-Set* system

. . . newest advance in industrial process control

A complete, integrated line . . .

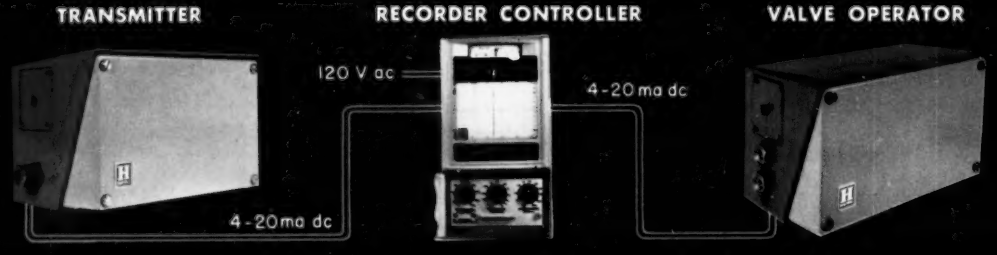
Control *any* industrial process with the *ElectriK Tel-O-Set* system. It has been designed as a complete system, rather than as a collection of individual instruments. The line consists of 22 major units which permit local and centralized data presentation, adjustable cascade control, ratio control and many other auxiliary functions. *ElectriK Tel-O-Set* transducers make the line completely compatible with your present pneumatic instruments.

. . . built for industry

Die-cast aluminum cases and stainless steel components are used throughout the line to withstand the rough handling and demanding environments of industrial applications. Standardized components, together with extensive use of quick-connect and plug-in design, mean ready interchangeability of parts, reduced spare parts inventory, easy maintenance. The modular, or "building block" concept is employed throughout for maximum flexibility.

. . . this is how it works

The basic *ElectriK Tel-O-Set* system consists of a transmitter, receiver, controller and final control element. The transmitter measures any process variable, translates it into a standard 4 to 20 milliampere direct current signal, and transmits to the receiver through a pair of copper wires. The receiver indicates or records the signal in terms of the actual value of the process variable, compares it with a pre-determined set-point, and sends the difference to the controller as an error signal. The controller then converts this into a corrective 4-20 milliampere output to operate the control valve—again transmitting over a single pair of copper wires.



All process and external electric connections to *ElectriK Tel-O-Set* field-mounted transmitters are entirely isolated from inside the case . . . to permit installation without the need for instrument department supervision.

All receivers, from single-point indicator without control to two-pen ratio-cascade control station, are housed in the same case and all use the same panel cutout of 5½ x 6 inches. Controllers can be mounted with adjustments in front or back of panel.

All *ElectriK Tel-O-Set* field-mounted units . . . whether transmitter, transducer, or valve actuator . . . operate at ambient temperatures of —40 to 150° F. They all work on the same force-balance principle and use many similar components.

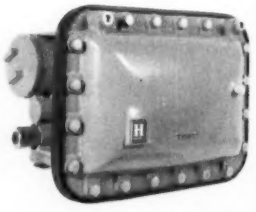
CHOICE OF THREE CASES

For field-mounted *ElectriK Tel-O-Set* units: Weatherproof for Division 2 locations; relay rack for mounting four abreast in a 19-inch rack, and explosion-proof for Division 1 locations.

All are completely transistorized and have quick-connect electric and pneumatic plugs.

Weatherproof

Relay rack



Explosion-proof

SYSTEM COMPONENTS

TRANSMITTERS
Process pressure to current (PP/I)
Differential pressure to current (Δ P/I)
Millivolt to current (MV/I)

RECORDERS
Single or two-pen recorders. Single or two-pen recording controllers with control, including simple cascade, on one pen. Two-pen recording controllers with ratio or cascade control on one pen.

INDICATORS
One pointer, with or without control
Milliammeter, with or without manual loading

CONTROLLERS
Two mode and three mode

FINAL CONTROL ELEMENTS
Current to pressure (I/P) valve operator
Electro-pneumatic positioner
Electro-hydraulic actuator

TRANSDUCERS
P/I: 3-15 psi to 4-20 ma dc
I/P: 4-20 ma to 3-15 psi
I/F: 4-20 ma dc to frequency
F/I: frequency to 4-20 ma dc

Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

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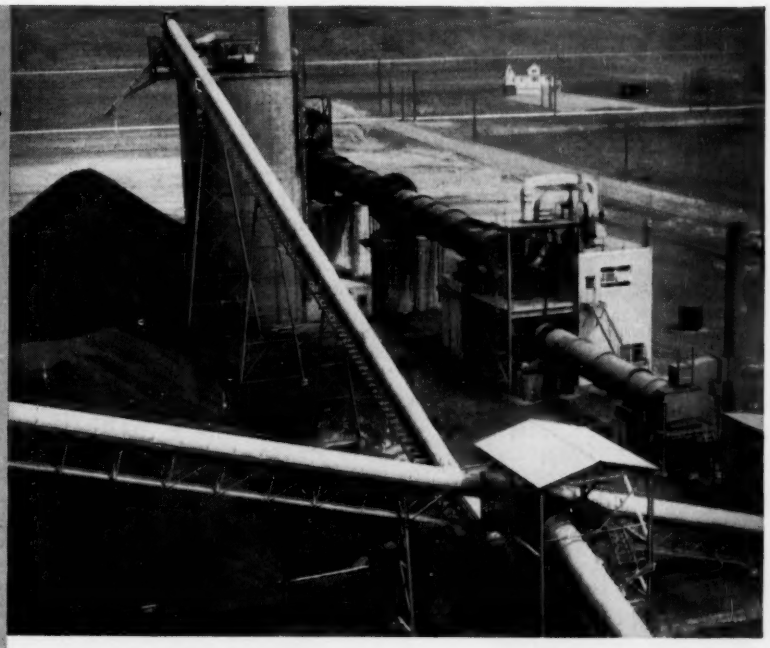
KENNEDY Coke-calcining Kilns

Mountaineer Carbon Company achieves higher yields and better quality at their new Cresap, W. Va. coke-calcining plant—with a KENNEDY Kiln and KENNEDY Kiln Accessories.



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Mountaineer averages better than 75% yield, several percentage points higher than older installations. And the coke is more uniform in density.

Mountaineer gains these advantages through close control of combustion. A single gas-fed burner in hood at discharge end of kiln generates a temperature of about 2,500 F. Flame configuration, primary and secondary air flows are all controlled carefully; seals cut leakage of unwanted air.

This close control of combustion allows some burning of cracked gases from coke bed. Yet, it prevents unwanted combustion of carbon which reduces yields in most coke calcining. Too, it produces uniform density in finished product, a direct result of uniform temperature.

Kiln is 180 ft. long and 10.5 ft. in dia. Rotating at about 1 rpm., it retains coke approximately 100 min.

KENNEDY equipment is behind the high performance record of this new plant:

- The 180′ long kiln with its bronze sleeved, self-aligning bearings, 3-tire supports and drive assembly;
- Special feed and discharge air seals which reduce air leakage and improve combustion control;
- The kiln firing hood with its extra large access doors for maintenance;
- The air cooled nose ring assembly, specially designed by KENNEDY for coke-calcining.

When you are in need of kilns—for lime, calcined coke, dead burned dolomite, cement by wet or dry process, nodulizing and agglomerating or drying—consult KENNEDY. You can be assured of quality equipment that delivers high, long-lasting performance.

See pages 419–423 in your Chemical Engineering Catalog for a full listing of Kennedy Products for the Chemical & Process Industries

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White oil . . . for medicinal, cosmetic, and industrial applications.

Urea for Oil Dewaxing

Taking advantage of the adduct principle enables specialty refiner to dewax white oil by filtration.

TURNING an analytical tool into a successful commercial operation—that's the engineering achievement behind the oil dewaxing operation at L. Sonneborn's Petrolia, Pa., refinery. This unit employs the urea adduct principle (*Chem. Eng.*, Nov. 1956, pp. 114-116) to remove straight-chain waxes from a specialty white oil.

Although urea dewaxing has found limited use in the oil industry, Sonneborn claims two "firsts" for its unit: (1) It was the first to employ the urea dewaxing principle on a commercial scale (late 1950); (2) Patented urea regenerating process (U.S. 2,731,455) keeps the urea in solid state at all times, simplifying the process. Other urea dewaxing schemes dissolve urea in water at one stage which means that the urea must then be recrystallized from aqueous solution for recycle.

Described here for the first time, Sonneborn's dewaxing operation is used as a finishing step in production of a medicinal white oil which must meet exacting standards. Removing 3-4% of straight-chain hydrocarbons from the oil greatly improves pour-point and cloud-point, allowing the oil to pass U.S.P. specifications (which are not usually applied to this type of oil). Pour point is lowered from 25 F. to 0 F. while cloud points drops from 40 F. to 6-8 F. after the urea dewaxing operation.

▶ **Adduct Principle**—In oil, the urea crystal can be thought of as a pipe. Straight-chain molecules will slide into these "pipes" and the solid urea is then filtered out, taking the wax with it. Aromatic and ring compounds

Unfold Flowsheet

Bank of Settlers
Raw oil mixes with sulfuric acid to remove organic impurities; sludge settles out in these vessels and is processed to reclaim the acid.

are too bulky to fit into the adducts.

Wax is then removed from the adduct by treating with hot oil, dissolving out the wax. In this way, urea is kept in the solid state, greatly simplifying its recovery and reuse. Urea adduct can also be destroyed by dissolving the urea in hot water, freeing the straight-chain waxes. This is the procedure used by Standard of Indiana's urea dewaxing unit.

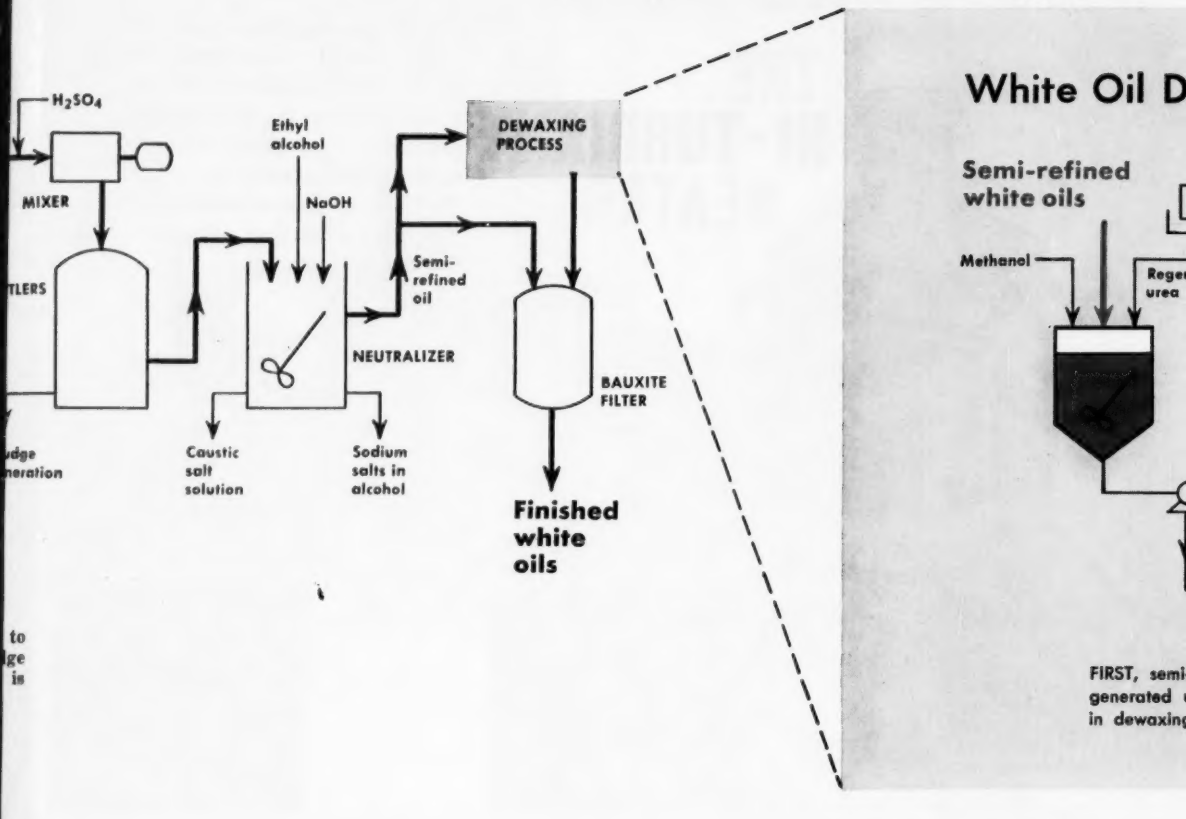
▶**Simplicity Pays Off**—Equipment in the dewaxing operation consists simply of two 5,000-gal. stirred tanks, a pump and a rotary vacuum filter.

The one operator on the unit comprises two-thirds of the total operating cost. Sonneborn estimates that scaling up the unit three-fold for use in lube oil dewaxing would make it competitive with conventional solvent dewaxing procedures.

Developed in the plant's own laboratory, the dewaxing operation is typical of the process simplicity and ingenuity found in the Petrolia refinery, according to plant manager Hans Schindler. "Knowing how to economically inter-relate our petrolatum, wax, white oil and sulfonate operations (all starting from a West Texas distillate) is the secret of our business," says Schindler.

▶**Batch Dewaxing**—Total time cycle for dewaxing a batch of oil and then regenerating the urea is about 7 hr.

Around 2,500 gal. of raw oil is charged to the dewaxing tank along with about 4,300 lb. of urea and 45 gal. of methanol. Methanol acts as an activator, greatly speeding the dewaxing action of the urea—although no



one knows why. Batch is stirred for one hour at ambient temperature to complete dewaxing.

▶**Regenerating Urea** — At the end of an hour, the urea-oil slurry is pumped up to the second floor to the rotary vacuum filter. Waxy urea filter cake drops by gravity through a chute into the regenerating tank. Dewaxed white oil flows to storage tanks for final filtering through bauxite and packaging.

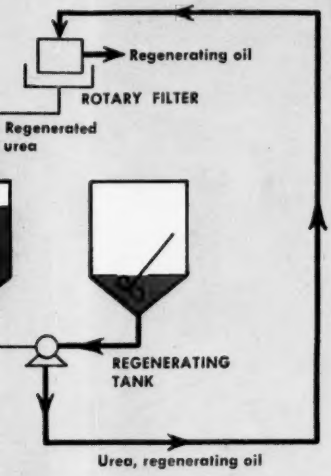
Regenerating oil (same type as the purified white oil) flows from storage into the tank through a preheater. Oil temperature in the tank is carefully regulated at 225-228 F. by steam coils in the bottom. One pint of ditertiary-parabutyl-cresol added to the batch keeps the oil from oxidizing and poisoning the urea. A small amount of water is also added to speed separation of wax from the urea adduct. Again, the reason why water has this accelerating effect is not understood.

▶**Starting Over**—After about an hour of agitation, dewaxed urea crystals and the regenerating oil is pumped back up to the rotary filter. Regenerated urea filter cake falls through a chute back into the dewaxing tank for another dewaxing cycle.

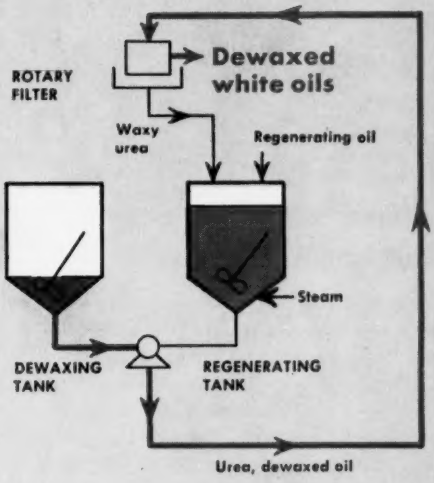
Waxy regenerating oil flows back to storage where it is used over again. After five regenerating cycles, the waxy oil is used in the formulation of "a special product."

Urea can be reused for 100 dewaxing cycles after which it is discarded because it becomes too finely divided and clogs the filter. Periodic additions are made to the original urea charge when the pour point of the finished oil begins to get above 8 F.

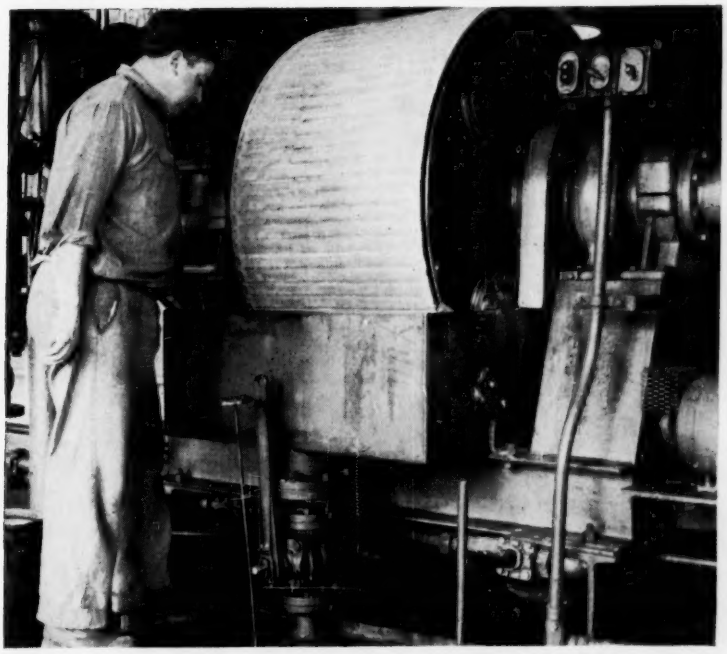
Dewaxing With Urea—Two-Stage Batch Process



semi-refined white oil mixes with re-
ated urea and is stirred for one hour
vaxing tank.



WAXY UREA then filters out of dewaxed oil, to be dewaxed in hot oil and then returned for another cycle.



Rotary Filter

Filter on second floor of dewaxing building separates urea from both dewaxed oil and regenerating oil.

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the know-how
the equipment
and the experience
for solving problems involving fluids

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water treatment	distillation
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fluid analysis	piping
reactions	storing
agitation	heat transfer
	centrifuging

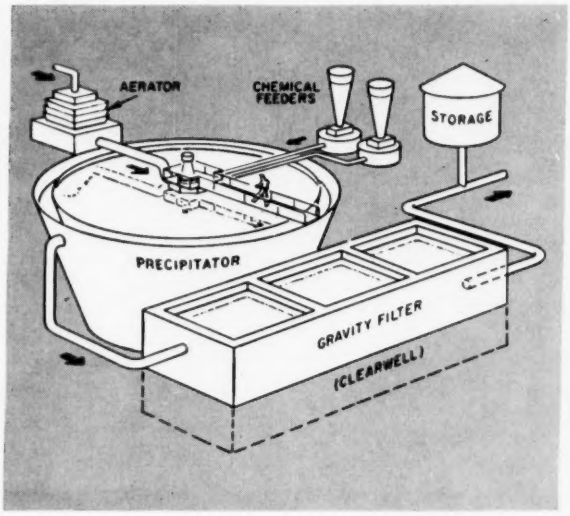
FLUIDICS AT WORK

Selecting water treatment systems to meet your specific needs

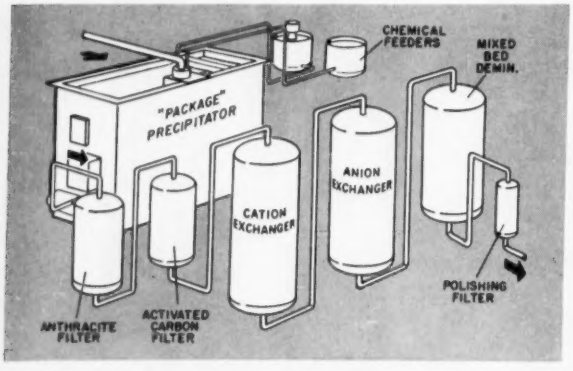
Many factors are involved in proper selection of water treatment equipment for specific use. Analysis of the raw water, volume and quality of water required, cost of equipment (both initial and operating), amortization rates and plans for future expansion, to cite just a few. The systems illustrated typify answers to widely varying requirements.

If you are concerned with any phase of water conditioning, bring an outline of your requirements to Permutit. As the largest and most experienced producer of water treatment equipment of every type, Permutit can assure you sound recommendations and the most efficient and economical system available for your particular need.

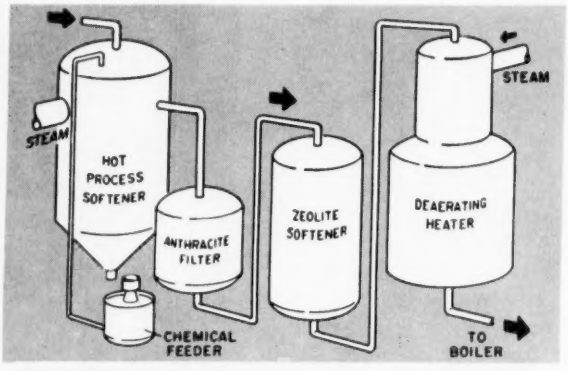
Write to the Permutit Division, Dept. CE-59, 50 West 44th Street, New York 36, New York . . . or Permutit Company of Canada Ltd., Toronto 1, Ontario.



Well water for municipal supply. Aerator reduces CO_2 to lower acidity, reduces taste and odor and oxidizes dissolved iron and manganese. Precipitator removes turbidity, color, hardness and oxidized iron and manganese. Gravity filters remove remaining traces of turbidity.



Process water for electronic components. Package Precipitator removes bulk of turbidity, hardness and iron. Anthracite filter removes remaining suspended matter. Activated carbon filter takes out color and absorbs dissolved organics. Demineralizer—cation, anion, and mixed bed — reduces dissolved solids to guaranteed maximum. Polishing filter removes traces of suspended matter.



Water for steam boiler. Hot process softener reduces hardness to a few grains per gallon. Also reduces silica. Anthracite filter removes remaining turbidity. Zeolite softener may be added to system where zero hardness is needed. Finally, the deaerating heater removes oxygen to prevent corrosion.

PFAUDLER PERMUTIT INC.

SPECIALISTS IN FLUIDICS . . . THE SCIENCE OF FLUID PROCESSES

HIGHER *Thermal Efficiencies . . . . .* ***GREATER*** *Savings In Industrial Process Heating!*

THE HI-TURBIANT HEATER

If you have any process operations — large or small — where process fluids are heated, directly or indirectly, investigate now the substantially greater thermal efficiencies and lower operating costs the Hi-Turbiant Heater is bringing to other processing applications similar to yours.

As shown in the cutaway view, the Hi-Turbiant has both radiant and re-radiant heating zones — a unique advancement that insures more uniform heat absorption throughout the entire tubular network!

High fluid turbulence, maintained by high-temperature pumps, reduces boundary-layer vaporization and assures substantially greater heat efficiencies without vaporization problems!

More uniform heating permits greater height-to-diameter ratio — therefore fewer "hairpins" in the tube system for more efficient fluid flow, lower pumping costs, greater operating economies!

Because of these and other unique Hi-Turbiant advancements, you make multiple savings in process heating applications — savings in size of unit required, savings in fuel costs, savings in pumping costs, savings in plant space. Send for illustrated bulletin that gives detailed data and shows typical systems. *Ask for Bulletin #HT-100!*

TWO BROAD FIELDS OF APPLICATION!

1. Heating Transfer Fluids (Dowtherm, Aroclor, Hydrocarbon oils, etc.) used in heat processing.
2. Direct Firing of process streams (Rich-Oil denuding, asphalt heating, etc.) where fluids must be heated under close thermal control.

In both types of application, the Hi-Turbiant Heater brings new standards of efficiency, new savings in processing costs!

COMPLETE RANGE OF SIZES — ½ TO 40 MILLION BTU/Hr.

Also, single user "package" units 200,000 to 1,500,000 BTU/Hr.

There's a Hi-Turbiant Heater to fit your requirements!

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COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Jet-Cleaned Filters
THERM-O-FLEX Hi-Temp Filters
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HOLO-FLITE Processors
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Low in cost...
easiest to program and operate...
most in demand

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The powerful, compact LGP-30 provides you with fast, accurate answers in all types of statistical studies – analysis of variance, regression analysis, etc. – also allows you to optimize heat exchanger, distillation column and other equipment design. Other important CPI jobs include mass spectrometer analysis and refinery process simulation. Solutions are printed out in any desired alpha-numeric format – require no deciphering. Result: the LGP-30 relieves you of the tedium of detailed calculation . . . allows you to handle more assignments . . . frees your time for further creative work.

The LGP-30 offers you capacity comparable to computers many times its size and cost. It has a magnetic drum memory of 4096 words and is by far the easiest computer to program in basic machine language. The LGP-30 operates from any convenient wall outlet . . . requires no special installation or air conditioning. Auxiliary high-speed input-output equipment is available for increased operational speed.

Backed by 20 years of electronics experience, LGP-30 sales and service are available through Royal McBee offices coast-to-coast. Customer training is free. An extensive library of programs and sub-routines is available (including Box technique for experimental design) – as well as membership in an active users organization.

For further information and specifications, write Royal McBee Corporation, Data Processing Division, Port Chester, N. Y. In Canada: The McBee Co., Ltd., 179 Bartley Drive, Toronto 16.

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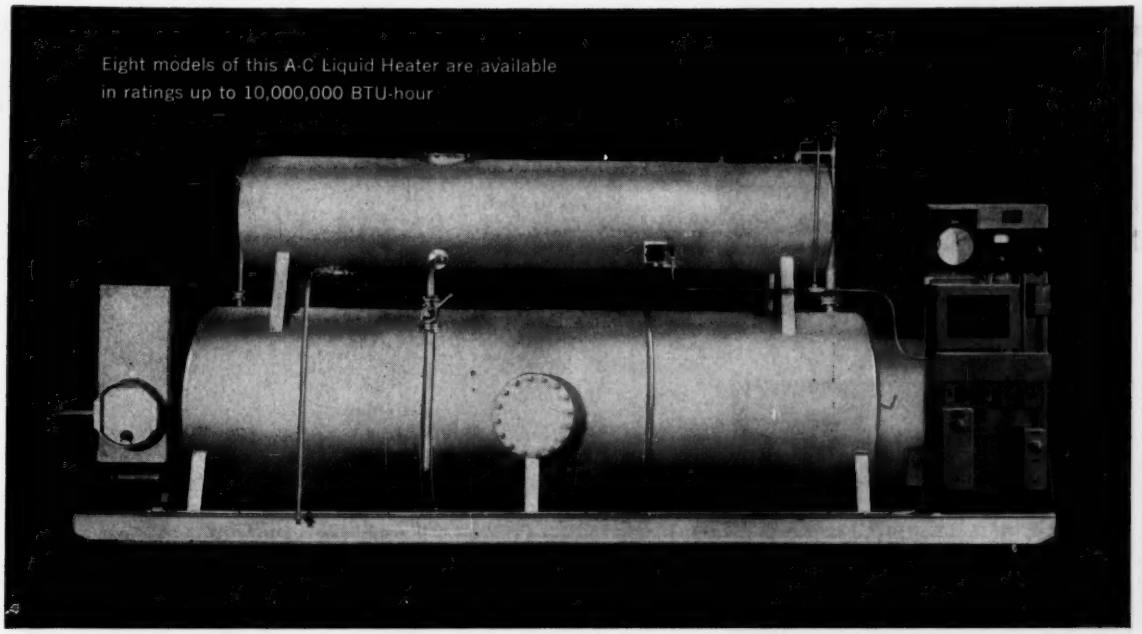

Need Automatic, Accurate, Indirect Process Heat Up To 650° F?

CHECK THIS NEW LIQUID HEATING SYSTEM

This new Allis-Chalmers Liquid Heater *operates at atmospheric pressure.* It is thoroughly stable and fully automatic. It generates and delivers heat up to 650°F with safety and economy. In any process requiring accurately-controlled heat, the A-C Liquid Heater gives you these advantages:

Increases Your Output – Applied to existing equipment, this low-pressure system can deliver higher processing temperatures that increase production and lower costs. On new construction, its flexibility eliminates the need for auxiliary equipment, permits simplified design without high-pressure code vessels, cuts initial cost.

Close, Automatic Temperature Control – The temperature of the heat transfer medium in the A-C Liquid Heater is independently controlled. Thus the heated liquid is *always* at a predetermined temperature.

Completely Safe – A-C Liquid Heaters are thermally stable, will not air-lock, vapor-bind or flood. Explosion hazards are eliminated.

Economical to Install, Operate – Initial installation cost is usually less than one cent per BTU per hour of gross heat load on most units. There are no complicated start-up or shut-down procedures; system operates automatically with only monitoring of instruments required.

For bulletins containing complete information on this new Liquid Heating System, contact your nearest Allis-Chalmers office, or write Allis-Chalmers Manufacturing Co., Hydraulic Division, York, Pa.

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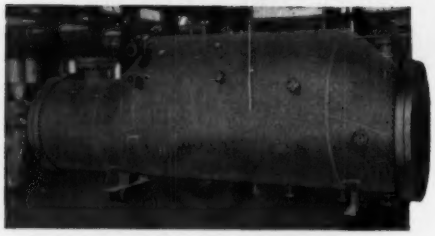
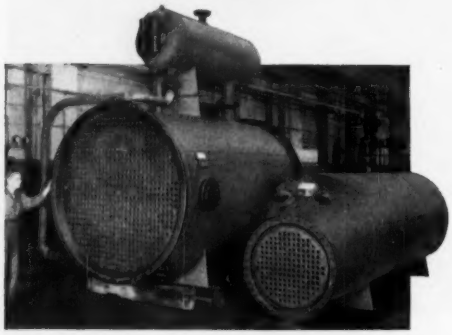


1 A nitric acid plant installed this unit. It has a built-in platinum catalyst chamber.



2 A methanol plant operates these horizontal type units.

5 TYPES OF *Waste Heat* STEAM GENERATORS

Each of the units shown were custom designed to solve the specific problems peculiar to individual plant processes.

Vogt engineers are available to help you develop the right equipment to efficiently provide low cost steam from process heat. There's no obligation.

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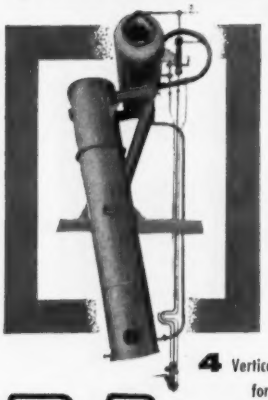
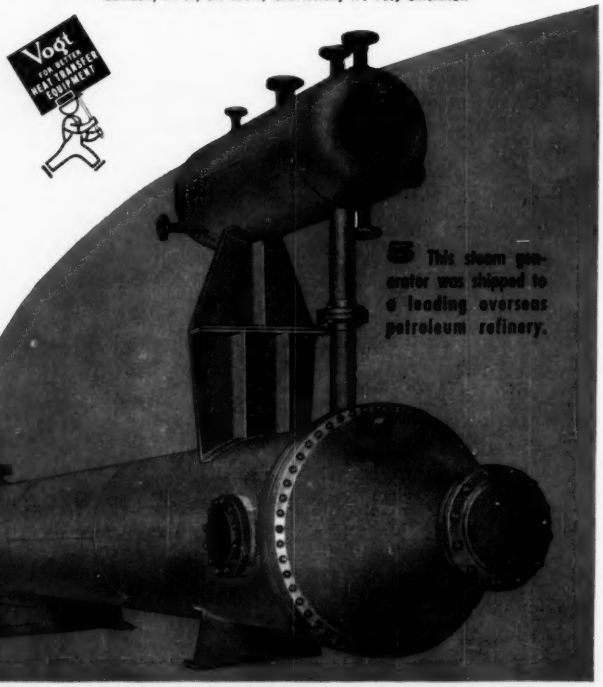
3 Horizontal unit for a nitric acid plant.



4 Vertical type unit for a hydrogen plant.



5 This steam generator was shipped to a leading overseas petroleum refinery.

Vogt HEAT TRANSFER EQUIPMENT

Chemical Engineering
MAY 18, 1959

Chemicals From Petroleum

Honoring the Fifth World Petroleum Congress, here's a special guided tour through petrochemical land. Fold-out "maps" show key routes. Exclusive survey tells where to buy know-how.

RAYMOND F. FREMED, Associate Editor, Chemical Engineering

THEY'RE on their way. Within the next two weeks—and before your next issue of *Chemical Engineering* arrives—more than 5,000 delegates to the Fifth World Petroleum Congress will arrive in New York City.

They'll be coming from at least 50 nations of the world, arriving by land, sea and air in time for the start of registration at the New York Coliseum (Columbus Circle) on Saturday May 30. First formal session—followed by an informal reception—will be held Sunday May 31 at the Waldorf-Astoria Hotel.

Many of the delegates will also attend the midyear meeting of American Petroleum Institute's Division of Refining at the Hotel Statler-Hilton in New York. API has arranged for back-to-back scheduling by deliberately breaking precedent and assigning May 27-29 dates for their annual refining get-together.

Meanwhile, other groups of delegates will be touring U. S. oil, petrochemical, automotive and atomic plants just prior to the Congress, or immediately following its close on June 5.

Special "all-expense-included" tours have been arranged by American Express Co. In an attempt to please all tastes, these tours run the gamut from the International Petroleum Exposition in Tulsa, Okla.; to petrochemical plants, refineries and off-shore drilling platforms along the Gulf Coast; to several oil research centers in the Midwest; to Washington, D. C.; and to the Copacabana night club floor show back in New York.

A CHEMICAL ENGINEERING REPORT

Chief function of the Congress, however, is to arrange a meeting every four years at which engineers and scientists can:

- Discuss technical problems.
- Narrow the gap between the research laboratories of the world and full-scale plant operations.

Previous convocations of the Congress were in Rome (1955), The Hague (1951), Paris (1937) and London (1933).

This year in New York, almost 300 technical papers have been scheduled for presentation and discussion in 100 technical sessions spread over five days. Specially designed movable-panel walls will divide the third floor of the Coliseum into 11 large meeting rooms with seating capacities ranging from 300 to 550. While the technical sessions are being held upstairs, 20,000 invited guests will tour the exhibit booths on the first and second floors of the Coliseum. Here, new products and methods will be displayed by more than 250 exhibitors.

Approximately a third of the technical papers will be of special interest to engineers. Two of the ten major sections of the Congress are devoted to petrochemicals and petroleum compounds.

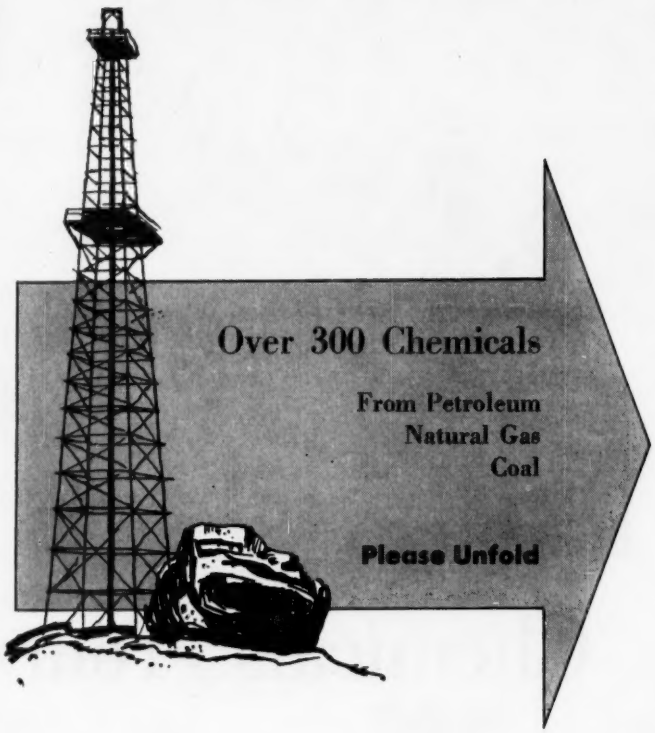
Scanning the program, we get the impression that each company or nation represented has saved its best technical punch over the past four years, so that it can be delivered as part of this Fifth World Petroleum Congress. The subjects are outstanding.

A sampling of the papers of interest appeared in our previous issue (*Chem. Eng.*, May 4, 1959, p. 58). Also the June 1 issue of *Chemical Engineering* will report on some new engineering developments that will be revealed for the first time at the Congress.

We think that you will be particularly interested in Section IV of the Congress, "Chemicals From Petroleum and Natural Gas." Therefore, we dedicate this *Chemical Engineering* Feature Report to the wonderland of complexity that maintains its sovereignty over chemicals, petroleum and natural gas.

Here's your chance to join a special tour, leaving right now for petrochemical wonderland.

Come with us through the looking glass.



How to Get From Here to There via

Petrochemical Routes

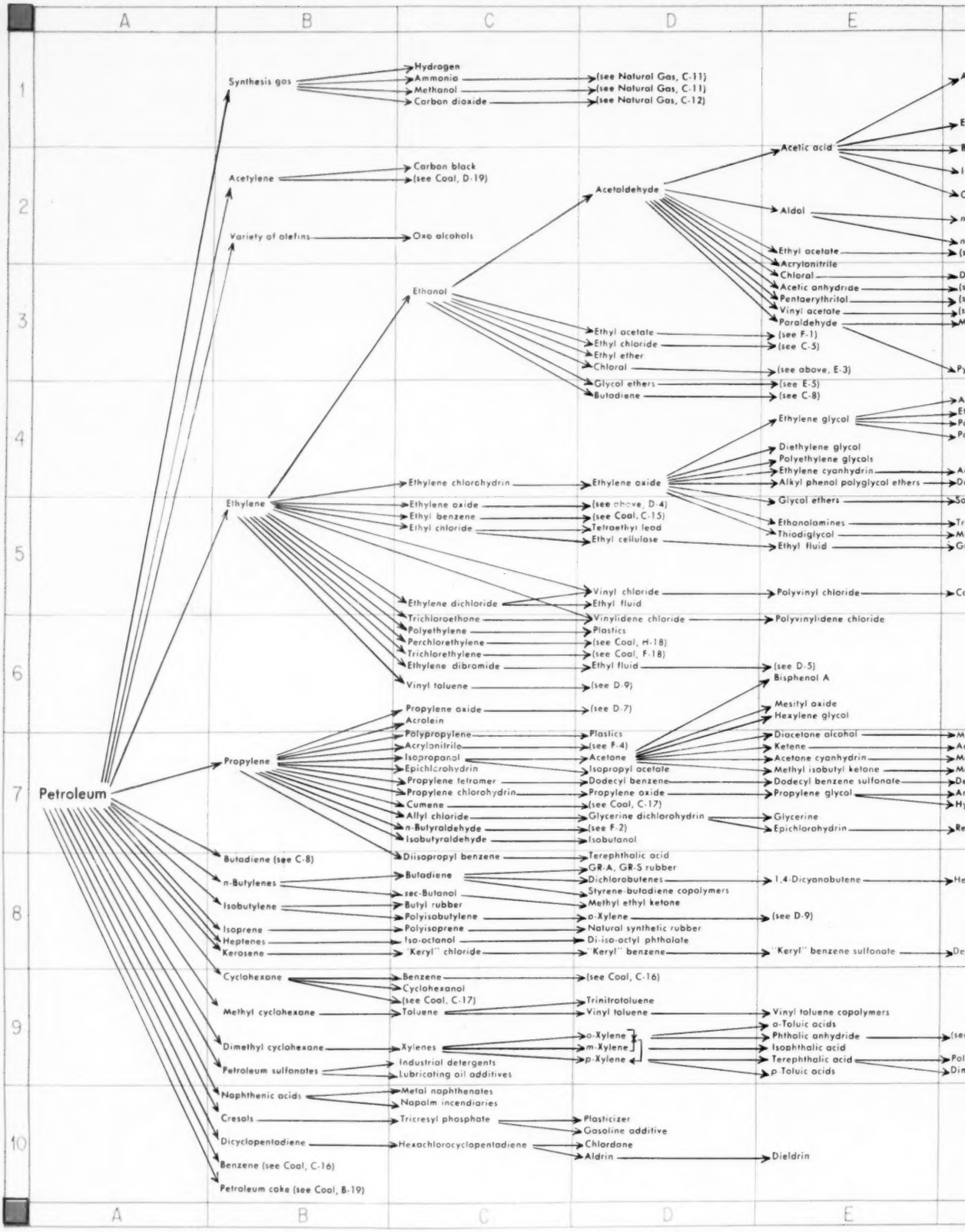
STOPPED at an unfamiliar crossroad, the motorist will reach into the glove compartment of his car and extract a road map.

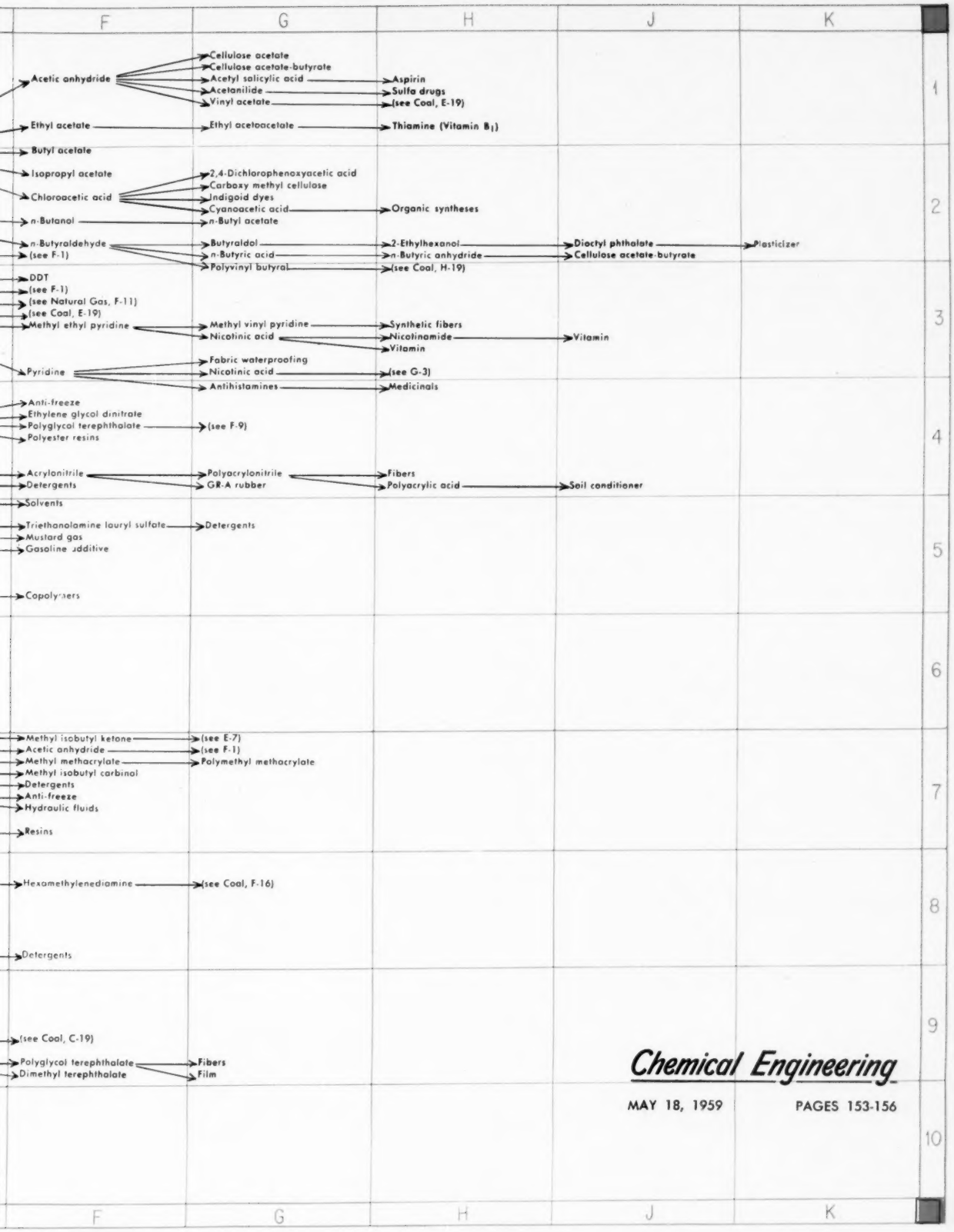
After a few moments of unfolding and orientation, he will—if he's lucky—point his index finger at some spot on the map and say, "I am here." Then he mouths the follow-up:

"How do I get from here to there?"

The fold-out map which you see on your right is included as an integral and significant part of this report because it provides the answer to this very question for anyone who wants to get about in petrochemical land. After a few moments of unfolding and orientation, the maps will enable you to spot a process route that has been engineered previously and is now a technical success.

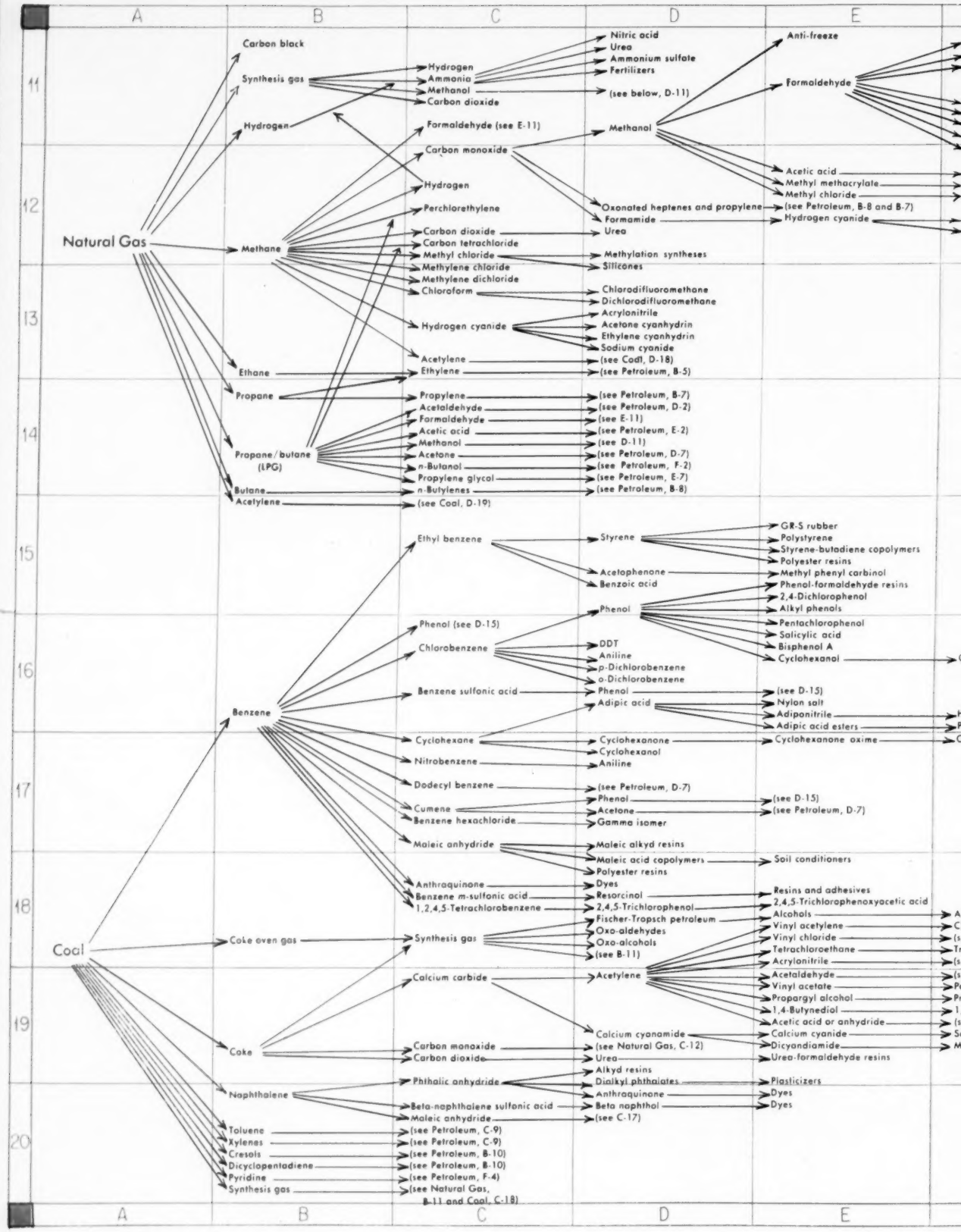
For the basic structure of our charts, we have been granted permission by Stanford Research

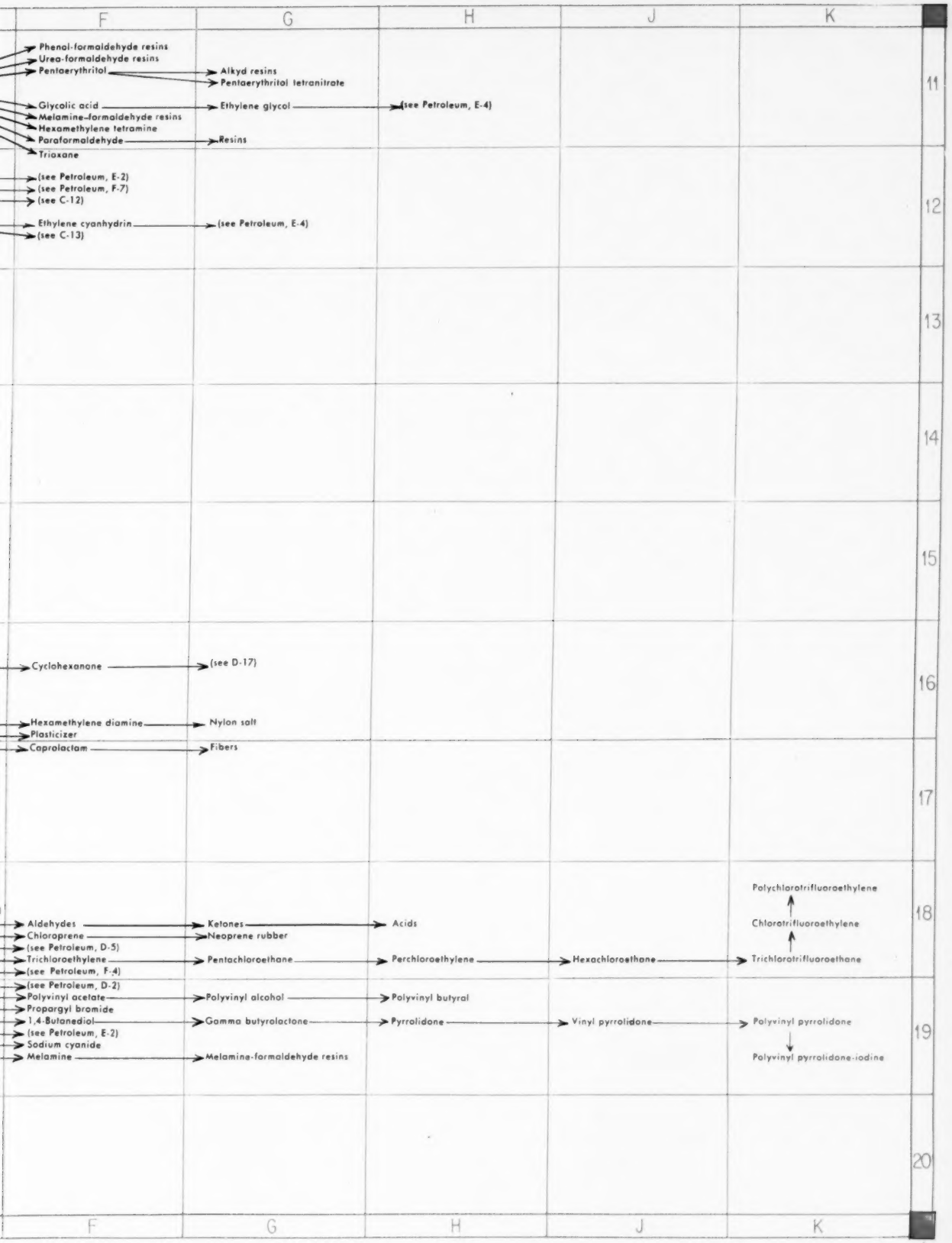

A
B
C
D
E
1
2
3
4
5
6
7
8
9
10
Petroleum
Synthesis gas
Hydrogen
Ammonia
Methanol
Carbon dioxide
(see Natural Gas, C-11)
(see Natural Gas, C-11)
(see Natural Gas, C-12)
Acetylene
Carbon black
(see Coal, D-19)
Variety of olefins
Oxo alcohols
Ethanol
Acetaldehyde
Acetic acid
Aldol
Ethyl acetate
Acrylonitrile
Chloral
Acetic anhydride
Pentaerythritol
Vinyl acetate
Paraldehyde
Ethyl acetate
Ethyl chloride
Ethyl ether
Chloral
Glycol ethers
Butadiene
(see F-1)
(see C-5)
(see above, E-3)
(see E-5)
(see C-8)
Ethylene
Ethylene chlorohydrin
Ethylene oxide
Ethyl benzene
Ethyl chloride
(see above, D-4)
(see Coal, C-15)
Tetraethyl lead
Ethyl cellulose
Ethylene glycol
Diethylene glycol
Polyethylene glycols
Ethylene cyanhydrin
Alkyl phenol polyglycol ethers
Glycol ethers
Ethanolamines
Thiodiglycol
Ethyl fluid
Ethylene dichloride
Trichloroethane
Polyethylene
Perchlorethylene
Trichlorethylene
Ethylene dibromide
Vinyl toluene
Vinyl chloride
Ethyl fluid
Vinylidene chloride
Plastics
(see Coal, H-18)
(see Coal, F-18)
Ethyl fluid
(see D-9)
Polyvinyl chloride
Polyvinylidene chloride
(see D-5)
Propylene
Propylene oxide
Acrolein
Polypropylene
Acrylonitrile
Isopropanol
Epichlorohydrin
Propylene tetramer
Propylene chlorohydrin
Cumene
Allyl chloride
n-Butyraldehyde
Isobutyraldehyde
(see D-7)
Plastics
(see F-4)
Acetone
Isopropyl acetate
Dodecyl benzene
Propylene oxide
(see Coal, C-17)
Glycerine dichlorohydrin
(see F-2)
Isobutanol
Bisphenol A
Mesityl oxide
Hexylene glycol
Diacetone alcohol
Ketene
Acetone cyanhydrin
Methyl isobutyl ketone
Dodecyl benzene sulfonate
Propylene glycol
Glycerine
Epichlorohydrin
Butadiene (see C-8)
n-Butylenes
Isobutylene
Isoprene
Heptenes
Kerosene
Diisopropyl benzene
Butadiene
sec-Butanol
Butyl rubber
Polyisobutylene
Polyisoprene
Iso-octanol
"Keryl" chloride
Terephthalic acid
GR-A, GR-S rubber
Dichlorobutenes
Styrene-butadiene copolymers
Methyl ethyl ketone
o-Xylene
Natural synthetic rubber
Di-iso-octyl phthalate
"Keryl" benzene
1,4-Dicyanobutene
(see D-9)
"Keryl" benzene sulfonate
Cyclohexane
Methyl cyclohexane
Dimethyl cyclohexane
Petroleum sulfonates
Benzene
Cyclohexanol
(see Coal, C-17)
Toluene
Xylenes
Industrial detergents
Lubricating oil additives
(see Coal, C-16)
Trinitrotoluene
Vinyl toluene
o-Xylene
m-Xylene
p-Xylene
Vinyl toluene copolymers
o-Toluic acids
Phthalic anhydride
Isophthalic acid
Terephthalic acid
p-Toluic acids
Naphthenic acids
Cresols
Dicyclopentadiene
Benzene (see Coal, C-16)
Petroleum coke (see Coal, B-19)
Metal naphthenates
Napalm incendiaries
Tricresyl phosphate
Hexachlorocyclopentadiene
Plasticizer
Gasoline additive
Chlordane
Aldrin
Dieldrin



Chemical Engineering

MAY 18, 1959 PAGES 153-156


A
B
C
D
E
11
12
13
14
15
16
17
18
19
20
Natural Gas
Coal
Carbon black
Synthesis gas
Hydrogen
Methane
Ethane
Propane
Propane/butane (LPG)
Butane
Acetylene
Benzene
Cyclohexane
Nitrobenzene
Dodecyl benzene
Cumene
Benzene hexachloride
Maleic anhydride
Anthraquinone
Benzene m-sulfonic acid
1,2,4,5-Tetrachlorobenzene
Benzene sulfonic acid
Chlorobenzene
Ethyl benzene
Coke oven gas
Coke
Naphthalene
Toluene
Xylenes
Cresols
Dicyclopentadiene
Pyridine
Synthesis gas
Hydrogen
Ammonia
Methanol
Carbon dioxide
Formaldehyde (see E-11)
Carbon monoxide
Perchlorethylene
Carbon tetrachloride
Methyl chloride
Methylene chloride
Methylene dichloride
Chloroform
Hydrogen cyanide
Acetylene
Ethylene
Propylene
Acetaldehyde
Formaldehyde
Acetic acid
Methanol
Acetone
n-Butanol
Propylene glycol
n-Butylenes
(see Coal, D-19)
Phenol (see D-15)
Synthesis gas
Calcium carbide
Carbon monoxide
Carbon dioxide
Phthalic anhydride
Beta-naphthalene sulfonic acid
Maleic anhydride
(see Petroleum, C-9)
(see Petroleum, C-9)
(see Petroleum, B-10)
(see Petroleum, B-10)
(see Petroleum, F-4)
(see Natural Gas, B-11 and Coal, C-18)
Nitric acid
Urea
Ammonium sulfate
Fertilizers
(see below, D-11)
Methanol
Oxonated heptenes and propylene
Formamide
Urea
Methylation syntheses
Silicones
Chlorodifluoromethane
Dichlorodifluoromethane
Acrylonitrile
Acetone cyanhydrin
Ethylene cyanhydrin
Sodium cyanide
(see Coal, D-18)
(see Petroleum, B-5)
(see Petroleum, B-7)
(see Petroleum, D-2)
(see E-11)
(see Petroleum, E-2)
(see D-11)
(see Petroleum, D-7)
(see Petroleum, F-2)
(see Petroleum, E-7)
(see Petroleum, B-8)
Styrene
Acetophenone
Benzoic acid
Phenol
DDT
Aniline
o-Dichlorobenzene
p-Dichlorobenzene
Phenol
Adipic acid
Cyclohexanone
Cyclohexanol
Aniline
(see Petroleum, D-7)
Phenol
Acetone
Gamma isomer
Maleic alkyd resins
Maleic acid copolymers
Polyester resins
Dyes
Resorcinol
2,4,5-Trichlorophenol
Fischer-Tropsch petroleum
Oxo-aldehydes
Oxo-alcohols
(see B-11)
Acetylene
Calcium cyanamide
(see Natural Gas, C-12)
Urea
Alkyd resins
Dialkyl phthalates
Anthraquinone
Beta naphthol
(see C-17)
Anti-freeze
Formaldehyde
Acetic acid
Methyl methacrylate
Methyl chloride
(see Petroleum, B-8 and B-7)
Hydrogen cyanide
GR-S rubber
Polystyrene
Styrene-butadiene copolymers
Polyester resins
Methyl phenyl carbinol
Phenol-formaldehyde resins
2,4-Dichlorophenol
Alkyl phenols
Pentachlorophenol
Salicylic acid
Bisphenol A
Cyclohexanol
(see D-15)
Nylon salt
Adiponitrile
Adipic acid esters
Cyclohexanone oxime
(see D-15)
(see Petroleum, D-7)
Soil conditioners
Resins and adhesives
2,4,5-Trichlorophenoxyacetic acid
Alcohols
Vinyl acetylene
Vinyl chloride
Tetrachloroethane
Acrylonitrile
Acetaldehyde
Vinyl acetate
Propargyl alcohol
1,4-Butynediol
Acetic acid or anhydride
Calcium cyanide
Dicyandiamide
Urea-formaldehyde resins
Plasticizers
Dyes
Dyes


F
G
H
J
K
Phenol-formaldehyde resins
Urea-formaldehyde resins
Pentaerythritol
Alkyd resins
Pentaerythritol tetranitrate
11
Glycolic acid
Ethylene glycol
(see Petroleum, E-4)
Melamine-formaldehyde resins
Hexamethylene tetramine
Paraformaldehyde
Resins
Trioxane
(see Petroleum, E-2)
(see Petroleum, F-7)
(see C-12)
12
Ethylene cyanhydrin
(see Petroleum, E-4)
(see C-13)
13
14
15
Cyclohexanone
(see D-17)
16
Hexamethylene diamine
Nylon salt
Plasticizer
Caprolactam
Fibers
17
Polychlorotrifluoroethylene
Aldehydes
Ketones
Acids
Chlorotrifluoroethylene
18
Chloroprene
Neoprene rubber
(see Petroleum, D-5)
Trichloroethylene
Pentachloroethane
Perchloroethylene
Hexachloroethane
Trichlorotrifluoroethane
(see Petroleum, F-4)
(see Petroleum, D-2)
Polyvinyl acetate
Polyvinyl alcohol
Polyvinyl butyral
Propargyl bromide
1,4-Butanediol
Gamma butyrolactone
Pyrrolidone
Vinyl pyrrolidone
Polyvinyl pyrrolidone
19
(see Petroleum, E-2)
Sodium cyanide
Melamine
Melamine-formaldehyde resins
Polyvinyl pyrrolidone-iodine
20
F
G
H
J
K

Institute, Menlo Park, Calif., to use their product flow charts of the organic chemical industry, as published in the "Chemical Economics Handbook." SRI first published these charts in 1951; then reissued revised versions as part of the Handbook in March 1954.

The Stanford Research charts, you must remember, were designed to provide an economic service for the subscribers to the "Chemical Economics Handbook." For this reason chemicals with a production volume in excess of 25 million lb./yr. or over $5-million were selected for inclusion. However, some consideration was given to developments on the verge of commercial importance in 1954.

On the original charts the entries in each column are listed in the order of their tonnage production, or in the order of the consumption of that chemical in the manufacture of other chemicals. In the past five years, this ranking order has changed substantially. Also, some of the processes which SRI included because they were on the threshold of importance have now become actual commercial successes. Others have failed to develop.

Then, there are the new processes which have become available to engineers only within the last few years.

Within the next year or so, SRI hopes to begin the economic studies that would generate a new set of ranked-order charts. In the meantime we offer our 1959 technical update of the 1954 economic charts.

Here's what we've done. Copies of the charts, stripped of all identification, were distributed to more than 100 engineers associated with about 40 engineering and chemical process companies throughout the U. S. and abroad. These engineers were told that the charts represented the petrochemical industry in 1954 and we asked the reviewers to tell us what processes had been developed commercially in the past five years that should now be included on the charts.

We also suggested that if any of the mapped routes had become impassable, they should be marked for deletion.

Most active areas of technical progress have been the demonstrations of capability for using petroleum feedstocks, natural gas, liquefied petroleum gas and coal relatively interchangeably as starting points for building a petrochemical complex.

For example, synthesis gas can now be produced from almost any of the above mentioned starting materials. And we have heard persistent rumors that even wood might be a potential starting point. Acetylene, a basic petrochemical raw material, is now available directly from petroleum, from natural gas, from methane, from LPG and from coal-based calcium carbide. Hydrogen, another popular starting point, can pop up almost anywhere on the map.

Of course, ethylene is still the most active petrochemical feedstock on the market. However, note how populated the area surrounding propylene has become. When suburban ethylene and propylene become too congested, look for new subdivisions to spring up around *n*-butylene and isobutylene. With the expiration of some basic patents in acetylene chemistry last year and this, watch for more traffic in acetylene derivatives.

These new charts include many of the process routes suggested by our reviewers. Our aim has been to draw an accurate picture of technical feasibility and the availability of engineering know-how on process routing, and we claim no economic order of entry for the listings in any column.

In the index which starts below and carries on for the next two pages you will find an alphabetical census of the inhabitants of petrochemical land. Coordinates indicate where they can be found on the maps.

You will also find bold numbers after many of the entries in the index. These numbers indicate that know-how concerning routes leading to or from these particular chemicals is listed as available from companies referred to in the next section of this report.

Chemicals, Chart Locations, *Who Offers Process*

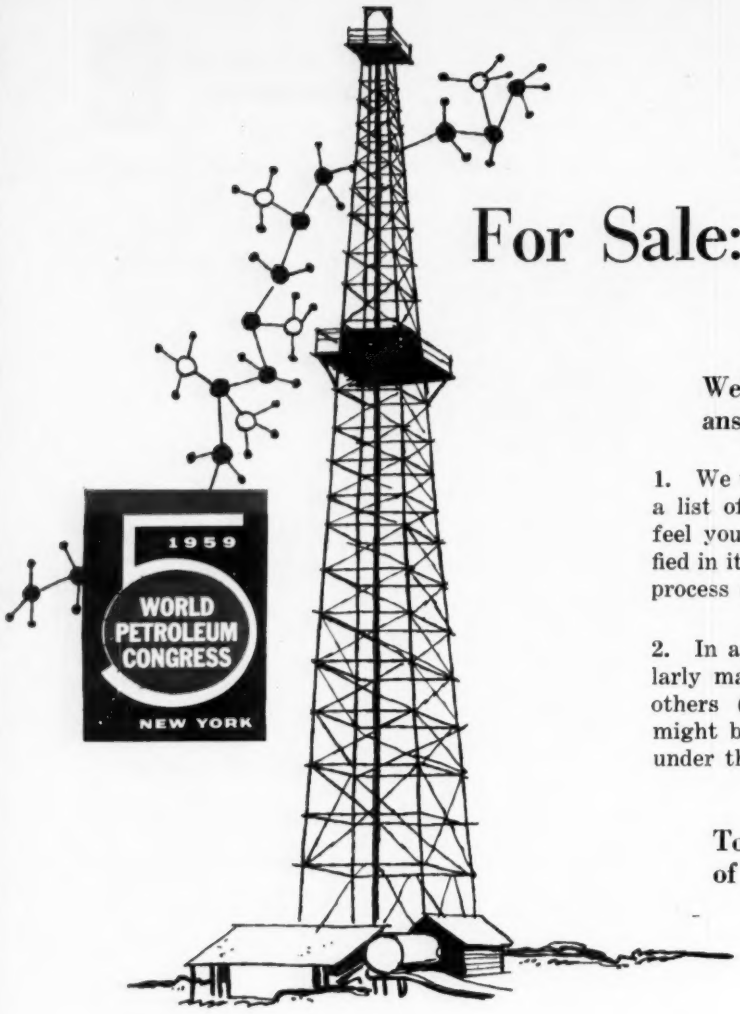
Acetaldehyde, C-14, D-2, E-19, **1, 3, 8, 16, 21, 29, 36**
Acetanilide, G-1
Acetic acid, C-14, E-2, E-12, E-19, **1, 3, 8, 10, 16, 36**
Acetic anhydride, E-3, E-19, F-1, F-7, **3, 8, 16**
Acetone, C-14, D-7, D-17, **3, 5, 8, 16, 17, 18, 29, 35**
Acetone cyanhydrin, D-13, E-7, **8, 21, 36**
Acetophenone, D-15
Acetylene, B-2, B-15, C-13, D-19, **3, 4, 5, 8, 10, 12, 14, 16, 17, 18, 19, 21, 24, 25, 31**
Acetyl salicylic acid, G-1
Acrolein, C-6, **3**
Acrylonitrile, C-7, D-13, E-3, E-18, F-4, **1, 3, 5, 8, 16, 17**
Adipic acid, D-16, **8, 29**
Adipic acid esters, E-16
Adiponitrile, E-16
Aldol, E-2, **16**
Aldrin, D-10
Alkyl phenols, E-15, **4**
Alkyl phenyl polyglycol ethers, E-4
Allyl chloride, C-7, **3, 5, 17**
Ammonia, C-1, C-11, **3, 5, 8, 11, 12, 14, 16, 17, 19, 20, 21, 22, 24, 27, 31, 36**
Ammonium sulfate, D-11, **3, 5, 8, 17, 20, 21, 31**
Aniline, D-16, D-17
Anthraquinone, C-18, D-20
Antihistamines, G-4
Benzene, B-10, B-16, C-9, **1, 4, 5, 18, 21, 24, 27, 35, 36**
Benzoic acid, D-15, **29**
Benzene *m*-disulfonic acid, C-18
Benzene hexachloride, C-17
Benzene sulfonic acid, C-16, **18**

Chemicals, Chart Locations, *Who Offers Process*

Beta-naphthalene sulfonic acid, C-20, 16
Beta naphthol, D-20
Bisphenol A, E-6, E-16, 1, 29
Butadiene, B-8, C-8, D-4, 1, 3, 4, 5, 9, 11, 12, 15, 17, 18, 19, 20, 21, 25, 27, 32, 36
Butadiene-styrene copolymers, D-8, 4, 20, 32
Butane, B-14, 4, 12, 18, 21, 24, 25, 27
1, 4-Butanediol, F-19, 21
n-Butanol, C-14, F-2, 1, 3, 16, 36
sec-Butanol, C-8, 1, 3, 5, 17, 21, 29, 36
Butyl acetate, F-2, 4
n-Butyl acetate, G-2, 16
n-Butylenes, B-8, C-14, 4, 5, 8, 12, 15, 18, 20, 21, 22, 25, 27, 32, 35
Butyl rubber, C-8, 5, 9, 11, 20
1, 4-Butynediol, E-19, 21
n-Butyraldehyde, C-7, F-2, 16, 36
Butyraldol, G-2
n-Butyric acid, G-2
n-Butyric anhydride, H-2
Calcium carbide, C-19, 4, 16
Calcium cyanamide, D-19, 16
Calcium cyanide, E-19
Caprolactam, F-17, 5, 16
Carbon black, B-11, C-2, 3, 4, 8, 16, 17, 18, 21, 25
Carbon dioxide, C-1, C-11, C-12, C-19, 4, 8, 14, 18, 20
Carbon monoxide, C-12, C-19, 4, 8, 14, 16, 18, 24
Carbon tetrachloride, C-12, 1, 3, 5, 8, 16, 21, 29
Carboxy methyl cellulose, G-2, 16
Cellulose acetate, G-1
Cellulose acetate-butyrate, G-1, J-2
Chloral, D-3, E-3
Chloroacetic acid, F-2, 36
Chlorobenzene, C-16, 8, 14, 16, 21, 29
Chlorodifluoromethane, D-13
Chloroform, C-13, 3, 5, 16, 21, 29
Chloroprene, F-18, 16
Chlorotrifluoroethylene, K-18
Coke, B-19
Coke oven gas, B-18
Cresols, B-10, B-20, 16, 22,
Cumene, C-7, C-17, 3, 4, 5, 6, 8, 17, 18, 19, 20, 21, 29, 35
Cyanoacetic acid, G-2
Cyclohexane, B-9, C-17, 1, 4, 8, 12, 18, 24, 35
Cyclohexanol, C-9, D-17, E-16, 29
Cyclohexanone, D-17, F-16, 29
Cyclohexanone oxime, E-17
DDT, D-16, F-3, 8
Diacetone alcohol, E-7, 1, 5, 16, 17, 29
Dialkyl phthalates, D-19, 4, 5, 29
o-Dichlorobenzene, D-16, 16, 21
p-Dichlorobenzene, D-16, 16, 21, 36
Dichlorobutenes, D-8, 5
Dichlorodifluoromethane, D-13
2,4-Dichlorophenol, E-15
2,4-Dichorophenoxyacetic acid, G-2
Dicyandiamide, E-19, 16
1,4-Dicyanobutene, E-8
Dicyclopentadiene, B-10, B-20
Dieldrin, E-10
Diethylene glycol, E-4, 16, 29
Di-iso-octyl phthalate, D-8, 4
Diisopropyl benzene, C-8, 25, 29
Dimethylcyclohexane, B-9
Dimethyl terephthalate, F-9, 29
Dioctyl phthalate, J-2
Dodecyl benzene, C-17, D-7, 1, 4, 8, 18, 21, 22
Dodecyl benzene sulfonate, E-7, 4, 17
Epichlorohydrin, C-7, E-7, 3, 29
Ethane, B-13, 8, 18, 21, 24
Ethanol, C-3, 1, 3, 5, 8, 11, 17, 18, 21, 29, 36
Ethanolamines, E-5, 1, 3, 4, 5, 14, 29
Ethyl acetate, D-3, E-2, F-1, 4, 16
Ethyl acetoacetate, G-1, 16
Ethyl benzene, C-5, C-15, 1, 3, 4, 8, 17, 18, 20, 21, 29, 35
Ethyl cellulose, D-5
Ethyl chloride, C-5, D-3, 3, 4, 5, 19, 21, 24, 29
Ethylene, B-5, C-13, 1, 3, 5, 8, 15, 16, 17, 18, 19, 21, 22, 24, 25, 31, 36
Ethylene chlorohydrin, C-4, 8, 16, 29
Ethylene cyanhydrin, D-13, E-4, F-12, 8
Ethylene dibromide, C-6
Ethylene dichloride, C-5, 3, 5, 8, 12, 16, 17, 20, 24
Ethylene glycol, E-4, G-11, 1, 3, 4, 5, 12, 15, 16, 17, 21, 24, 29, 31, 32
Ethylene glycol dinitrate, F-4
Ethylene oxide, C-5, D-4, 3, 4, 5, 8, 12, 15, 16, 17, 18, 21, 24, 29, 36
Ethyl ether, D-3, 1, 3, 5, 16, 18, 36
2-Ethyl hexanol, H-2
Ethyl toluene, 3
Fischer-Tropsch petroleum, D-18
Formaldehyde, C-11, C-14, E-11, 3, 4, 8, 14, 16, 17, 18, 21, 22, 24, 29, 36
Formamide, D-12, 16, 18
Gamma butyrolactone, G-19, 21
Gamma isomer (benzene hexachloride), D-17
Glycerine, E-7, 5, 17, 24, 29
Glycerine dichlorohydrin, D-7
Glycol ethers, D-4, E-5, 1, 16
Glycolic acid, F-11
GR-A rubber, D-8, G-4, 4, 15, 17, 25, 32
GR-S rubber, D-8, E-15, 4, 15, 17, 20, 25, 32
Heptenes, B-8, 4
Hexachlorocyclopentadiene, C-10
Hexachloroethane, J-18
Hexamethylene-diamine, F-8, F-16, 14
Hexamethylene tetramine, F-11, 8, 14
Hexylene glycol, E-6, 3, 19, 29
Hydrogen, B-11, C-1, C-11, C-12, 5, 8, 12, 14, 16, 17, 20, 21, 22, 24
Hydrogen cyanide, C-13, E-12, 3, 8, 14, 16, 18, 21
Isobutanol, D-7, 36
Isobutylene, B-8, 3, 18, 22
Iso-octanol, C-8, 4, 36
Isophthalic acid, E-9, 1, 28, 29
Isopropanol, C-7, 1, 3, 5, 8, 16, 17, 18, 21, 22, 27, 29, 36
Isoprene, B-8, 1, 29
Isopropyl acetate, D-7, F-2, 4, 16
Kerosene, B-8, 18
"Keryl" benzene, D-8
"Keryl" benzene sulfonate, E-8
"Keryl" chloride, C-8
Ketene, E-7, 16, 21
Maleic acid copolymers, D-18, 4
Maleic alkyd resins, D-17, 4
Maleic anhydride, C-17, C-20, 1, 3, 4, 21, 29
Melamine, F-19, 8, 16

Chemicals, Chart Locations, *Who Offers Process*

Melamine-formaldehyde resins, F-11, G-19
Mesityl oxide, E-6, 5, 29
Metal naphthenates, C-10
Methane, B-12, 8, 16, 18
Methanol, C-1, C-11, C-14, D-11, 1, 3, 4, 8, 11, 12, 14, 16, 18, 19, 20, 21, 22, 24, 32, 36
Methylation syntheses, D-12
Methyl chloride, C-12, E-12, 3, 5, 8, 16, 21, 29
Methylcyclohexane, B-9
Methylene chloride, C-13, 3, 5, 21, 29
Methylene dichloride, C-13, 16, 21
Methyl ethyl ketone, D-8, 1, 5, 17, 29, 36
Methyl ethyl pyridine, F-3
Methyl isobutyl carbinol, F-7, 5
Methyl isobutyl ketone, E-7, F-7, 1, 5, 29
Methyl methacrylate, E-12, F-7, 1, 8, 20, 29
Methyl phenyl carbinol, E-15
Methyl vinyl pyridine, G-3, 3, 31, 32
Mustard gas, F-5
Naphthalene, B-20, 1, 5, 18, 22
Naphthenic acids, B-10, 18
Napalm incendiaries, C-10
Natural gas, A-12
Natural synthetic rubber, D-8
Neoprene rubber, G-18
Nicotinamide, H-3
Nicotinic acid, G-3
Nitric acid, D-11, 3, 5, 8, 14, 17, 19, 21, 22, 31
Nitrobenzene, C-17, 14, 16, 21
Nylon salt, E-16, G-16
Olefins, B-2, 6
Organic syntheses, H-2, 1
Oxo alcohols, C-2, D-18, 1, 14, 19, 24, 29
Oxo-aldehydes, D-18, 14, 19, 24, 29
Oxonated heptenes and propylene, D-12
Paraformaldehyde, F-11, 8
Paraldehyde, E-3
Pentachloroethane, G-18
Pentachlorophenol, E-16, 16
Pentaerythritol, E-3, F-11, 8
Pentaerythritol tetranitrate, G-11
Perchloroethylene, C-6, C-12, H-18, 5, 29
Petroleum, A-7
Petroleum coke, B-10
Petroleum sulfonates, B-9
Phenol, C-16, D-15, D-16, D-17, 1, 3, 4, 16, 18, 19, 21, 29, 35
Phenol-formaldehyde resins, E-15, F-11, 4
Phthalic anhydride, C-19, E-9, 1, 3, 6, 8, 16, 18, 21, 29
Plasticizers, D-10, E-19, F-16, K-2, 5
Plastics, D-6, D-7
Polyacrylic acid, H-4, 10
Polyacrylonitrile, G-4, 8, 10, 20, 32
Polychlorotrifluoroethylene, K-18
Polyester resins, D-18, E-15, F-4, 4, 32
Polyethylene, C-6, 3, 4, 5, 10, 11, 15, 19, 24, 25, 27, 29, 31
Polyethylene glycols, E-4, 29
Polyglycol terephthalate, F-4, F-9
Polyisobutylene, C-8, 5
Polyisoprene, C-8
Polymethyl methacrylate, G-7
Polypropylene, C-7, 3, 5, 8, 20, 24, 25, 29
Polystyrene, E-15, 4, 17, 22, 29
Polyvinyl acetate, F-19, 4, 16, 21
Polyvinyl alcohol, G-19, 16, 21
Polyvinyl butyral, G-3, H-19, 16
Polyvinyl chloride, E-5, 4, 12, 16, 17, 21, 22, 29, 32
Polyvinylidene chloride, E-6
Polyisoprene, C-8
Polyvinyl pyrrolidone, K-19, 21
Polyvinyl pyrrolidone-Iodine, K-19, 21
Propane, B-14, 8, 18, 21, 24, 27
Propane/butane (LPG), B-14, 18, 21
Propargyl alcohol, E-19, 21
Propargyl bromide, F-19, 21
Propylene, B-7, C-14, 18, 21, 22, 24
Propylene chlorohydrin, C-7, 29
Propylene glycol, C-14, E-7, 29
Propylene oxide, C-6, D-7, 8, 21, 29
Propylene tetramer, C-7, 4, 5, 8, 18, 21, 22, 24
Pyridine, B-20, F-3
Pyrrolidone, H-19, 21
Resins and adhesives, E-18
Resorcinol, D-18, 31
Salicylic acid, E-16
Silicones, D-13
Sodium cyanide, D-13, F-19
Soil conditioners, E-18, J-4
Styrene, D-15, 1, 3, 4, 5, 8, 9, 11, 12, 15, 17, 18, 20, 21, 27, 29, 35, 36
Styrene-butadiene copolymers, D-8, E-15, 4, 20, 32
Sulfa drugs, H-1
Synthesis gas, B-1, B-11, B-20, C-18, 5, 11, 12, 14, 20, 30, 33, 36
Terephthalic acid, D-8, E-9, 1, 8, 29
1, 2, 4, 5-Tetrachlorobenzene, C-18
Tetrachloroethane, E-18
Tetraethyl lead, D-5, 5
Thiamine (Vitamin B_1), H-1
Thiodiglycol, E-5
Toluene, B-20, C-9, 1, 3, 4, 5, 17, 18, 19, 24, 27, 35, 36
o-Toluic acids, E-9
p-Toluic acids, E-9
Trichloroethane, C-6
Trichloroethylene, C-6, F-18, 5, 17, 21
2, 4, 5-Trichlorophenol, D-18
2, 4, 5-Trichlorophenoxyacetic acid, E-18
Trichlorotrifluoroethane, K-18
Tricresyl phosphate, C-10, 4, 16
Triethanolamine lauryl sulfate, F-5
Trinitrotoluene, D-9
Trioxane, F-12
Urea, D-11, D-12, D-19, 3, 5, 8, 12, 16, 18, 22, 24, 31, 36
Urea-formaldehyde resins, E-19, F-11, 4
Vinyl acetate, E-3, E-19, G-1, 1, 3, 4, 21, 29
Vinyl acetylene, E-18, 16
Vinyl chloride, D-5, E-18, 1, 3, 4, 5, 8, 11, 12, 14, 16, 17, 21, 24, 29
Vinylidene chloride, D-6, 4, 29
Vinyl pyrrolidone, J-19, 21
Vinyl toluene, C-6, D-9, 3
Vinyl toluene copolymers, E-9
Vitamins, H-1, H-3
Xylenes, B-20, C-9, 1, 4, 5, 8, 17, 18, 24, 27, 35
m-Xylene, D-9, 17, 25
o-Xylene, D-9, 17, 18, 25
p-Xylene, D-8, D-9, 1, 5, 16, 17, 18, 25, 29



For Sale: Know-How for

We've spent five months amassing the answers to these important questions.

1. We would like you to prepare for our readers a list of petrochemical processes for which you feel your organization is particularly well qualified in its ability to supply engineering know-how, process design or services of a similar nature.

2. In addition to the processes which you regularly make available to all customers, are there others (either foreign or domestic) which you might be able to obtain for the right customer under the other circumstances?

To give you this exclusive directory of processes available for your use.

LONG before top management decides to allocate funds for the design and construction of a new petrochemical plant, engineers get to work making preliminary decisions on process alternatives and economic feasibility.

One of the first questions to be answered is: What process know-how is available?

Traditionally, the petroleum industry has purchased much of its refining know-how from engineering organizations; and traditionally, the chemical industry has developed its own engineering know-how, at great expense. This has dictated the economic necessity of cloaking chemical know-how in robes of secrecy.

In recent years as petroleum companies extended out into chemical operations, and as chemical companies reached back into production of petroleum chemicals, there has been considerable relaxation of secrecy and a more vigorous exchange of process ideas under licensing agreements.

This shopping guide for your tour through the process supermarket has been prepared as a service to engineers who are assigned the task of performing preliminary evaluations of technical alternatives. We have stocked the shelves of this supermarket by selecting some 40 representative companies from our list of more than 300 organizations that offer engineering, design and construction services to the chemical process industries.

Not every company we asked was willing to give us a reply. Also, the replies to our questions should not be considered to be all-inclusive in any particular case. In using the replies, or when you cross check with entries in the chemicals index starting on p. 157, please remember that the motto of this supermarket is: "If you don't see what you're looking for on the shelves, please ask for it and we'll try and locate it for you."

Perhaps a few words about our method of sampling are in order. From the list of over 300, we first selected those companies which are

Engineering Petrochemical Processes

well known to engineers in the chemical process industries. We selected target areas and *CE's* editors made calls in the following cities to gather the replies on a personal basis: Boston, New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Louisville, Chicago, Kansas City, Houston, Denver, Los Angeles and San Francisco.

Some of the information was solicited from overseas: France, Germany, Italy, South America and the United Kingdom.

Soon after the survey began last December, some of the respondents requested—since they were planning to release information which had never been made available before—that we do not permit any respondent to have access to the replies submitted by his competitors before the exclusive publication of the information in this Feature Report. This request has been honored.

Another question that popped up early and regularly was an explanation of our use of the words "petrochemical" and "petrochemical process."

Similarly, some of you may have been waiting very patiently for a rigid definition of the word "petrochemical" to appear somewhere in this text. Every author of the 1950's who has written in this field has stopped dead in his tracks in an early paragraph to explain his understanding of what is and what is not entitled to be called a petrochemical.

Most-accepted definition revolves around a family history stemming from a petroleum or natural-gas grandfather. A direct descendant of petroleum or natural gas could well be a member in good standing of the petrochemical family. But what about the black sheep with mixed blood lines?

For example, in the U. S. and in the United Kingdom ethanol is manufactured from petroleum via ethylene and from molasses by fermentation; in the U. S., Germany and Italy, acetylene is made both by partial combustion of natural-gas methane and from coal via calcium carbide. And we could go on and on.

The general definition breaks down completely when we consider a commercial operation in the Union of South Africa that starts with coal and converts it to petroleum products and thence to petrochemicals. Should we now be willing to accept the concept of petrochemicals from coal?

In the 1958 edition of "The Petroleum Chemicals Industry," by R. F. Goldstein, the author admits to the following dilemma:

"Other difficulties have presented themselves in deciding what is a petroleum chemical and what is not. It has been mentioned above that every organic chemical can be made from methane, and the availability of benzene, toluene, naphthalene, etc., from petroleum means that the whole field of synthetic aromatic compounds, including dyestuffs, medicinals, explosives and so on could be regarded as part of the field of petroleum chemicals."

Dr. Goldstein is absolutely correct. Since the basic definition claims a dominion over limitless boundaries, the territorial rights of the petrochemical empire are beginning to lose diplomatic respect and recognition from the rest of the chemical world.

"Petrochemicals" describes a system without boundaries in which dynamic processes maintain an unsteady-state that defies engineering analysis. The word "petrochemicals" in 1959 defines a socio-political-economic state rather than an engineering frame of reference.

Therefore, in the company listings that follow and in our roadmap guide to the wonderland of petrochemicals, we have agreed to allow the responding companies the privilege of setting their own boundaries, more or less.

The engineer who wants to find a more economical process route to any particular chemical product will not be concerned with whether it is called a chemical, a coal chemical, a natural-gas chemical or a petrochemical.

Here Are the Replies, Company by Company

1

Badger Manufacturing Co.
230 Bent St.
Cambridge 41, Mass.

For the processes listed below, Badger is prepared to offer engineering services under licensing, sub-licensing and/or know-how and secrecy agreements. Some are proprietary. Some are offered by others exclusively through Badger. Some are offered on a nonexclusive basis. Many of the processes listed are offered through foreign licensors. Of course, the list is only a representative sampling.

Processes for: acetaldehyde, acetic acid, acrylonitrile, amines, benzene, *bis*-phenol, butadiene, carbon tetrachloride, cyclohexane, diacetone alcohol, dodecyl benzene, esters, ethanol, ethers, ethyl benzene, ethylene, glycols, isophthalic acid, isoprene, maleic anhydride, methanol, methyl ethyl ketone, methyl isobutyl ketone, methyl methacrylate, naphthalene refining, oxo-alcohols, phenol, phthalic anhydride, styrene, sulfonation, sulfur,

terephthalic acid, toluene, vinyl acetate, vinyl chloride, xylenes.

2
BASF Incorporated
375 Park Ave.
New York 22, N. Y.

Regarding your article for the Fifth World Petroleum Congress, our people in Ludwigshafen (Badische Anilin & Soda Fabrik AG.) advise that they don't have a general list of processes which they would be prepared to license. Instead, each individual case would have to be judged on its own merits. We feel that this is the best way to serve the interests of both BASF and any potential licensee.

3
Bechtel Corp.
220 Bush St.
San Francisco 4, Calif.

We are well qualified to provide engineering know-how for the development of production facilities using a broad range of petrochemical processes. Typical processes are listed below.

Bechtel Corp. does not own or have any interest in licensed processes of its own. The Bechtel staff is qualified to perform work in conjunction with the process owner and in many cases designs facilities using processes developed by client chemical companies. Because we do not have a financial interest in any process, we feel that this puts us in an ideal position to make an objective selection in all cases solely in terms of the client's best interest.

Petrochemical processes for the production of: acetaldehyde, acetic acid, acetic anhydride, acetone, acetylene, acrolein, acrylonitrile, alcohols, allyl chloride, ammonia, amyl chloride, butadiene, carbon bisulfide carbon black, carbon tetrachloride, chloroform, cumene, dodecyl benzene, epichlorhydrin, ethylene, ethanolamines, ethyl benzene, ethyl chloride, ethyl ether, ethylene dichloride, ethylene oxide, ethyl toluenes, formaldehyde, glycols, hydrogen cyanide, hydrogen peroxide, isobutylene, isopropyl benzene, isopropyl ether, maleic anhydride, methylamines, methyl chloride, methyl ethyl ketone, methyl ethyl pyridine, methyl mercaptan, methylene chloride, methyl vinyl pyridine, phenol, phthalic anhydride, polyethylene, polypropylene, styrene, sulfur recovery, urea, vinyl acetate, vinyl chloride, vinyl toluene.

4
Blaw-Knox Co.
Chemical Plants Div.
300 Sixth Ave.
Pittsburgh 22, Pa.

The following are those petrochemical processes for which Blaw-Knox considers itself to be particularly well qualified to supply engineering know-how: synthetic rubber, vinyl chloride monomer, polyvinyl chloride and copolymers, vinyl acetate, polyvinyl acetate, polystyrene, polyester resins.

With respect to petrochemical processes, both foreign and domestic, which Blaw-Knox might be able to supply to the right customer under the right circumstances, we offer: SBA fatty alcohol process; Shell process for vinyl chloride monomer from ethylene; Blaw-Knox process for vinyl chloride monomer from acetylene; polyolefins process; Hercules process for olefins; and hydrogen from cracking of petroleum fractions and hydrocarbons.

Supplementing the information given above, we've marked up the charts you left with us, indicating those processes for which we feel we have applicable know-how. (See chemicals index, p. 157, code number 4.)

5
C. F. Braun & Co.
Engineers
Alhambra, Calif.

On the attached list (look for number 5 on chemicals index, p. 157) we show chemical products and families of products produced or recovered in process plants engineered, designed or constructed by Braun in recent years. These processes are partly indicative of our scope, but only partly.

We have been involved in pioneering the following processes: synthesis of isopropanol, *sec*-butanol, acetone and methyl ethyl ketone from refinery cracked-gases; butadiene by chlorination of butenes followed by dehydrochlorination; alkylation of butylenes and isobutane; isobutane by catalytic isomerization; toluene by extractive distillation; propylene to allyl alcohol; acetone to diacetone alcohols to methyl isobutyl ketone and methyl isobutyl carbinol; ethanol by direct vapor-phase hydration of ethylene; synthetic glycerine; ethanolamines; *p*-xylene by fractional crystallization; phthalic acids by liquid-phase oxidation of xylenes; and hydrogen peroxide from petrochemicals.

However, by long-standing policy we do not patent, license or engage in the promotion of chemical processes. We have no special interest in advocating one process or another. Yet we maintain close working agreements with many process licensors, both in the U. S. and abroad. We act as intermediary, when desirable, in the negotiation of licenses.

We evaluate many processes available only by license, without disclosing know-how. We do consulting work, engineer and build many plants using confidential or duly licensed processes. With this policy we can usually render our clients a distinct service through our completely impartial economic studies of several potential routes.

6
California Research Corp.
200 Bush St.
San Francisco 20, Calif.

Three petrochemical processes are available for licensing. They are: film-acid process for con-

40
Company Name

Identification numbers given above company names are used to key process listings in the chemicals index, which starts on p. 157.

version of gaseous olefins to liquid products; cumene from propylene and benzene by film-acid alkylation; phthalic anhydride from *o*-xylene.

7
Catalytic Construction Co.
1528 Walnut St.
Philadelphia 2, Pa.

Catalytic believes that the majority of new engineering projects will come as a result of work in the laboratories of the clients themselves, rather than through purchased know-how. Therefore, we are so set up that we are best qualified to work with the client on his engineering problems where the client has lab development know-how and desires to build a plant.

In answer to your question concerning our ability to supply process know-how for customers, Catalytic does not feel any need to obtain large numbers of processes. The bulk of the work done in the U. S. by firms such as ourselves has been with clients who supplied their own know-how. In dollar volume only a comparatively small amount was based on foreign processes. Catalytic, as well as other engineering companies, can get any petrochemical processes that are available and can offer them to any client.

8
Chemical Construction Co.
525 West 43rd St.
New York 36, N. Y.

Chemico is particularly well qualified to engineer plants for the production of: synthesis gas from methane; hydrogen, carbon monoxide, carbon dioxide; ammonia, urea, hydrogen cyanide, nitric acid; methanol, formaldehyde; ammonium sulfate, ammonium nitrate, amines and amides.

For the following petrochemical processes, we could offer engineering services capitalizing on the knowledge and prior experience of our engineering staff: carbon black, ethane, propane, ethylene, propylene, acetylene, acetaldehyde, formaldehyde, acetic acid, *n*-butylenes, ethyl benzene, chlorobenzene, cyclohexane, acetone cyanhydrin, styrene, DDT, adipic acid, methyl methacrylate, methyl chloride, pentaerythritol, melamine, hexamethylene tetramine and paraformaldehyde.

Also, ethyl alcohol, ethylene oxide, ethylene dichloride, isopropanol, propylene tetramer, propylene chlorohydrin, cumene, toluene, xylenes, acetaldehyde, acetic acid, acetic anhydride, ethylene cyanhydrin, acrylonitrile, acetone, dodecyl benzene, propylene oxide, phthalic anhydride, terephthalic acid and vinyl acetate.

9
Esso Research and Engineering Corp.
P.O. Box 243
Elizabeth B, N. J.

We offer the following petrochemical processes for license: butadiene by liquid-liquid extraction; production of butyl rubber and styrene.

10
Farnsworth & Chambers Co.
P. O. Box 74
Houston, Tex.

Can provide engineering, design and construction for these petrochemical processes: polyethylene, polyacrylates, polybutane, aldehydes, alcohols, amines, acetic acid, ketones, acetylene.

11
The H. K. Ferguson Co.
11th at Walnut St.
Cleveland 14, Ohio

The Ferguson Co. has built complete refineries and would be in a position to arrange for licensing and supply the engineering know-how for various components making up a refinery and associated chemical operations.

We could secure licensing where required and supply engineering know-how for these processes, for example: polyethylene, chlorinated hydrocarbons, vinyl chloride, synthetic fibers, partial-oxidation chemicals, methanol, ethanol, butadiene, styrene.

The company has many contacts throughout the U. S. chemical industry, and abroad, and many times we have secured specific process rights and plant financing for customers.

12
The Fluor Corporation, Ltd.
2500 S. Atlantic Blvd.
Los Angeles 22, Calif.

Fluor is in a position to furnish complete engineering know-how on the petrochemical processes listed below. Some of them require the execution of a license agreement; but these agreements are straightforward and are readily available to all of Fluor's customers.

Processes: acetylene from light hydrocarbons; ammonia; butadiene from *n*-butane; butadiene from butylene; synthesis gas by hydrocarbon-steam reforming or by partial oxidation; hydrogen; urea; cyclohexane from benzene; detergent alkylate; ethylene oxide by direct oxidation; ethylene glycol from ethylene oxide; ethylene dichloride from ethylene; methanol; vinyl chloride from ethylene dichloride.

Under some conditions, Fluor can supply engineering know-how on other petrochemical processes. These conditions involve business and licensing considerations that must be discussed with the process owner in each particular case.

These processes are: styrene synthesis; vinyl chloride from acetylene; polyvinyl chloride from vinyl chloride monomer; Freons.

13
Foster Wheeler Corp.
666 Fifth Ave.
New York 19, N. Y.

The Foster Wheeler Corp. and its associated companies provide a completely integrated worldwide service for process engineering, mechanical design and plant construction for all phases of process industry.

We develop projects on the basis of our own licenses, or in conjunction with processes owned by our clients; and we secure approval of other licensed processes for clients' use. Foster Wheeler maintains pilot-plant facilities

which are available to our clients for use in establishing process design and definition.

Here is a partial list of petrochemical processes which we are particularly well qualified to supply: ammonia, methanol, urea; partial oxidation of natural gas, refinery gas or fuel oil; vinyl chloride; alkyl benzene; cyclohexane; oxo alcohols; and styrene.

Also, butadiene extraction; butadiene from butane or from butylene; butylene from butane; isobutylene extraction; styrene-butadiene rubber compounding; hydrogen cyanide; butyl rubber; hydrogen fluoride; formaldehyde; acetylene; hydrogen.

And, carbon black; DDT; propylene tetramer; ethylene oxide; phenol (sulfonation); ethylene; phthalic anhydride; sulfur recovery; ethanol; isopropanol; hydrogen sulfide removal; maleic anhydride; carbon monoxide, carbon dioxide; hydrogen by steam-reforming of methane.

14

Girdler Construction Div.
Chemetron Corp.
Box 174
Louisville 1, Ky.

Following is a summary of processes available from Girdler Construction Div. of the Chemetron Corp., a design-engineering-construction organization serving chemical and petroleum industries: Girbitol purification process based on the use of aqueous solutions of ethanolamines to separate hydrogen sulfide and carbon dioxide from refinery gas, synthesis gas, hydrogen, inert gases and various liquid hydrocarbons.

Also, sulfur from hydrogen sulfide; carbon dioxide, either liquid or solid; production of hydrogen, carbon monoxide and synthesis gases; ammonia and hydrogen sulfide.

These licensed processes are also offered by the Girdler Construction Div.: nitric acid, under an agreement with Du Pont; prilled ammonium nitrate, Canadian Patents & Developments, Ltd.; Hooker Chemical Corp.'s anhydrous hydrogen chloride production process.

Girdler is the North American agent for these J. Meissner processes: nitration of materials such as glycerine, toluene, benzene, chlorobenzenes, glycols; hexamine.

Other processes offered include: Andrussnow hydrogen cyanide; Wulff process acetylene; phosgene; hot potassium carbonate gas purification.

The following are some of the processes owned by European and American chemical manufacturers who will supply Girdler with design information upon receipt of a *bona fide* inquiry: formaldehyde by oxide or silver catalyst processes, methanol synthesis from hydrocarbon feeds; oxo alcohols and aldehydes from propylene and higher olefins; vinyl chloride from acetylene or ethylene; ethanolamines production from ethylene oxide and ammonia.

15

Wyatt C. Hedrick Engineering Corp.
P. O. Box 1133
Houston 1, Tex.

Can conduct studies of processing feasibility, design and engineering for: ethylene, ethylene oxide, ethylene glycol, chlorinated aromatics, styrene, synthetic rubbers, organic sulfides.

Also, for: polyethylene, insecticides, butadiene and *n*-butylenes.

16

Hoechst-Uhde Corp.
Suite 8204
Empire State Building
350 Fifth Ave.
New York 1, N. Y.

For your petrochemical feature in connection with the Fifth World Petroleum Congress, we are pleased to make available for the first time anywhere this comprehensive list of processes for which know-how is available to us. As you know, Hoechst-Uhde offers various chemical processes for license in the U. S. Some of them are available generally, while others can be made available on a case-to-case basis, depending on the particular circumstances. Therefore, many of these processes require the specific approval of the licensor or owner of the know-how, as the case may be.

We should also point out that processes economically feasible in Europe may not be economically feasible in the U. S., and vice-versa. Thus, our willingness to offer certain processes on which we have know-how should not imply that we feel that the process is necessarily the most economic in every circumstance.

Here, then, is our list. Processes for converting petroleum, methane and natural gas to acetylene and to ethylene; methane to hydrogen cyanide; and coke to calcium carbide, thence to acetylene. Also, acetylene to carbon black; methane to hydrogen cyanide, carbon monoxide, methyl chloride, methylene dichloride, chloroform, carbon tetrachloride and hydrogen; ethanol to acetaldehyde, ethyl ether, glycol ethers, ethylene glycol, diethylene glycol, and polyethylene glycols; ethylene to ethylene chlorhydrin and ethylene dichloride; acetylene or ethylene dichloride to vinyl chloride; ethylene chlorhydrin to ethylene oxide.

Also, propylene to isopropanol to acetone and isopropyl acetate; acetone to diacetone alcohol and diketene; di-isobutylene to *p*-xylene; naphthalene to phthalic anhydride or beta-naphthalene sulfonic acid, and thence to beta-naphthol; hydrogen to ammonia to urea; carbon monoxide to methanol, methyl chloride and to formaldehyde; formamide to hydrogen cyanide; hydrogen cyanide to acrylonitrile.

And, acetylene to vinyl acetate to polyvinyl acetate to polyvinyl alcohol to polyvinyl butyral; acetaldehyde to acrylonitrile, aldol, ethyl acetate, vinyl acetate, ethyl acetate and acetic anhydride; acetic anhydride to cellulose acetate and vinyl acetate; ethyl acetate to ethyl acetoacetate; aldol to *n*-butyraldehyde to polyvinyl butyral; aldol to *n*-butanol to *n*-butyl acetate; acetic acid to isopropyl acetate and chloracetic acid to carboxy methyl cellulose.

Finally, acetylene to vinyl acetylene to chloroprene; coke to calcium cyanamide to dicyandiamide to melamine; phenol to caprolactam to Perlon; phenol to pentachloro-

phenol; cresol to tricresyl phosphate; and benzene to nitrobenzene and chlorobenzene to the dichlorobenzenes.

17
Holmes & Narver, Inc.
Petrochemical Div.
828 S. Figueroa St.
Los Angeles 17, Calif.

Personnel of this organization offer their experience in various aspects of process design, operation and contruction for these petrochemical processes: acetone, acetylene, alkyl aromatics, ammonia, ammonium nitrate, ammonium sulfate, butadiene, carbon black, cumene, detergent alkylates, detergent sulfonates, diacetone alcohol.

Also, ethyl alcohol, ethyl benzene, ethylene, ethylene glycol, ethylene oxide, formaldehyde, glycerine, hydrogen manufacture, isopropanol, methyl ethyl ketone, nitric acid, polystyrene, polyvinyl chloride, *sec*-butanol, styrene, sulfur, synthetic rubber, toluene, trichloroethylene and vinyl chloride.

Holmes & Narver also has access to other petrochemical processes not included in the listing above. These processes are available to customers after special negotiations have been completed.

18
Hydrocarbon Research, Inc.
115 Broadway
New York 6, N. Y.

Hydrocarbon Research is prepared to do the engineering on these chemical processes stemming from petroleum: ethanol to ethyl ether; ethylene to ethylene oxide and ethyl benzene; propylene to isopropyl alcohol, acetone, propylene tetramer, dodecyl benzene and cumene; butylene to butadiene; isobutylene to butadiene; cyclohexane to benzene; *o*-xylene; *p*-xylene; phthalic anhydride; detergents; and naphthenic acids.

From natural gas we can supply engineering services on these processes: carbon black; methane to carbon monoxide, methanol, formaldehyde, formamide, carbon dioxide, urea, hydrogen cyanide, acetylene; ethane to ethylene; propane to ethylene and propylene; propane/butane; butane; acetylene; benzene to ethyl benzene, styrene, benzene sulfonic acid, phenol, cyclohexane, cumene, phenol and acetone.

Other processes appear on the coal-based chart. They are: urea, naphthalene, toluene and xylenes.

19
The M. W. Kellogg Co.
711 Third Ave.
New York 17, N. Y.

In answer to your specific questions, our process position may be stated this way. The M. W. Kellogg Co. and its subsidiaries provide a complete international service from process development through design engineering, material procurement and plant construction regardless of process origin. Kellogg licenses processes it has developed such as ethylene, ammonia, Orthoflow fluid catalytic cracking, sulfuric acid alkylation, high-pressure steam-methane reforming, among the approximately forty processes offered.

In conjunction with its clients, Kellogg's research and development laboratories develop new processes, and its full pilot-plant facilities are available for new process testing and evaluation. Kellogg will evaluate available processes, secure approvals from licensors for the client's use and secure the licenses required. This has been done for over 20 processes. In addition, Kellogg will design and build plants using client-owned processes.

20
Walter Kidde Engineers-
Southwest, Inc.
1205 Holman Ave.
Houston 4, Tex.

Here is our list of a number of fields in which we can offer process design, mechanical engineering and construction ability. Process design and mechanical engineering for these organic chemicals: methyl amine, ethyl amine, propyl amine, butyl amine, butadiene, butylenes, ethyl chloride, butyl chloride, amyl chloride, cumene, ethyl benzene, methanol, butadiene-styrene-acrylonitrile copolymers, butyl rubber, GR-S rubber, styrene, benzene sulfonates and naphthalene sulfonates.

We offer engineering services for these inorganic chemicals which may be derived from petrochemical processes: ammonia, ammonium perchlorate, ammonium sulfate, carbon dioxide, hydrogen, hydrochloric acid, hydrocyanic acid, hydrofluoric acid, phosphoric acid and sulfuric acid.

21
The Lummus Co.
385 Madison Ave.
New York 17, N. Y.

Petrochemical processes for which we could supply engineering know-how include: hydrogen from methane (steam reforming) or by partial oxidation of hydrocarbons; ammonia and its derivatives; methanol; sulfur from off-gases; chlorination and oxidation of methane; acetylene from hydrocarbons; derivatives of acetylene including, acetaldehyde, vinyl acetate, polyvinyl acetate, polyvinyl alcohol, vinyl and polyvinyl chloride, trichloroethylene.

Also, ethylene from ethane, propane, butane, naphtha, heavier oils, etc; ethylene to ethanol, ethyl chloride, dichloroethane, vinyl chloride, polyvinyl chloride, ethylbenzene, styrene, ethylene oxide, ethylene glycol; propylene from propane, butane, etc; propylene to cumene, acetone, phenol, isopropyl alcohol, tetramer, ketene, diketene and propylene oxide; butylene from butane; butylene to butadiene, secondary butyl alcohol.

These aromatic processes: benzene from hexane; benzene to chlorobenzene, trichlorobenzene, maleic

40
Company Name

Identification numbers given above company names are used to key process listings in the chemicals index, which starts on p. 157.

anhydride, dinitrobenzene and dodecyl benzene; toluene from heptane; toluene to dinitrotoluene.

Under special conditions, we may be able to secure rights to these processes for certain customers: formaldehyde from methanol; phthalic anhydride from naphthalene; derivatives of acetylene by high-pressure syntheses; hydrogen cyanide from ammonia and methane.

22
Arthur G. McKee & Co.
2300 Chester Ave.
Cleveland, Ohio

The McKee Co. can supply engineering design and construction for these petrochemical processes: aromatics, butylene, dodecyl benzene, ethylene, hydrogen, hydrogen sulfide, isobutylene, naphthalene, *p*-cresol, petroleum polymers, phenol-cresol blends, polyvinyl chloride resin, propylene, propylene tetramer, sulfur, vinyl resins.

Also, under special licenses from the Hoechst-Uhde Corp., we can supply licensing, process know-how, engineering design and construction for these processes: ammonia and ammonium nitrate, carbon bisulfide, formaldehyde, isopropanol, methanol, nitric acid, polystyrene, urea.

23
Montecatini Soc. Gen. Chemore Corp.
21 West St.
New York 6, N. Y.

The Chemore Corp. represents the Montecatini organization on matters of technical interest in the U. S. In general, Montecatini considers itself to be a chemical operating company. However, under special arrangements, petrochemical processes developed in Italy by Montecatini are available for license in the U. S.

Montecatini has made the following processes available on a general basis: ammonia from any type of feed material; urea; methanol; nitric acid; ammonium nitrate or ammonium sulfate; formaldehyde; chloromethanes; and polystyrene.

Under special circumstances these processes may also be available: polypropylene for plastics; oxo alcohols, polyvinyl chloride; and acetaldehyde.

24
Ralph M. Parsons Co.
617 West 7th St.
Los Angeles 17, Calif.

Considering chemicals derived from petroleum we feel we are particularly well qualified to supply engineering know-how for the production of: ethylene, propylene, cyclohexane from petroleum or benzene, benzene, toluene, xylene, propylene polymers.

From natural gas, these production processes: methane, ethane, propane, butane, formaldehyde (or from LPG), methanol (or from LPG), ammonia (or from LPG), carbon monoxide, phosgene, hydrazine, hydrogen sulfide, sulfur from hydrogen sulfide, chlorinated and fluorinated hydrocarbons, hydrogen, urea.

Parsons could provide economically, for the right customer and under the right circumstances, processes such as these: synthetic glycerine, vinyl chloride, ethyl chloride, ethylene dichloride, polyethylene, oxo-alcohols, ethylene oxide, ethylene glycols, acetylene and many others.

25
Phillips Petroleum Co. Perco Division
Bartlesville, Okla.

In reply to your teletype, here is a selection among which are the principal petrochemical processes on which Phillips can do engineering process design or supply process know-how. They are: synthetic rubber manufacture; butanes and butenes dehydrogenation; furfural extractive distillation for butylenes recovery and butadiene recovery; oil-furnace carbon black; butane isomerization; continuous fractional crystallization; HF alkylation for alkyl benzene; olefin polymerization to yield polyolefin resins.

Also, aluminum chloride alkyation (diisopropyl process); acetylene from hydrocarbons; and the dimethyl formamide purification of ethylene and acetylene.

26
Procon, Inc.
1111 Mt. Prospect Road
Des Plaines, Ill.

Procon makes available all the petrochemical processes which can be licensed from Universal Oil Products Co. However, this is only done through licensing agreements with UOP. Procon does not own its own processes, rather, it operates as any other engineering and construction organization would in relation to UOP's processes or any other client-owned processes.

Therefore, Procon does not submit for your use a separate list of its petrochemical processes. Please refer to UOP's listing.

27
Refinery Construction Co. of Houston
P. O. Box 6734
Houston 4, Tex.

Provides engineering, design, and construction for: butadiene, isopropanol, toluene, xylene and benzene.

Also, provides engineering and design for these processes: butane, butylene. And construction services for: polyethylene, styrene, propane, Epon resins and ammonia.

28
Richfield Oil Co.
555 S. Flower St.
Los Angeles 13, Calif.

Richfield is not now licensing any of its processes. However, a company spokesman, in reply to *CE*'s questions, said this: "If any

40
Company Name

Identification numbers given above company names are used to key process listings in the chemicals index, which starts on p. 157.

interest develops, we would consider licensing our xylene oxidation process."

29
Scientific Design Co., Inc.
2 Park Ave.
New York 16, N. Y.

In response to your questions we have prepared two lists of processes. This first list gives those petrochemical processes which are in Scientific Design's direct field of activity. They could be offered to any and all potential customers. Processes for converting: benzene to maleic anhydride; methanol to formaldehyde; methane to methyl chloride, methylene chloride, chloroform, carbon tetachloride, perchloroethylene; LPG to carbon tetrachloride, perchloroethylene; ethyl benzene to styrene; ethylene to ethyl benzene, ethyl alcohol, ethylene chlorhydrin, ethylene oxide, polyethylene, ethyl chloride, vinylidene chloride, vinyl chloride.

Also, ethylene oxide to ethylene glycol, diethylene glycol; ethanol to acetaldehyde; cyclohexane to adipic acid, cyclohexanone, cyclohexanol; naphthalene or *o*-xylene to phthalic anhydride; propylene to isopropyl alcohol, propylene chlorhydrin, propylene oxide, propylene glycol; acetylene to vinyl chloride, vinyl acetate, polyvinyl chloride, vinyl chloride-vinyl acetate copolymer; phthalic anhydride to dibutyl phthalate, dioctyl phthalate.

There are other processes that are in Scientific Design's field of activity. However, please note that for this second list process availability is subject to special negotiation. Processes for converting: methanol and acetone plus hydrogen cyanide to methyl methacrylate; benzene to phenol, cumene; isopropyl alcohol to acetone; acetone to diacetone alcohol, methyl isobutyl ketone, hexylene glycol, mesityl oxide, methacrylate esters; ethylene oxide to ethanolamines.

Also, butylenes to *sec*-butanol, methyl ethyl ketone; various olefins to oxo-alcohols; propylene to epichlorohydrin, diisopropyl benzene; phenol and acetone to bisphenol A; various raw materials to synthetic glycerine; ethylbenzene to benzoic acid; styrene to polystyrene; ethylene oxide to polyethylene glycol; propylene oxide to polypropylene glycol.

And, diisopropyl benzene to terephthalic acid; benzene to cholorobenzene; mixed xylenes to *p*-xylene; *p*-xylene to terephthalic acid; *m*-xylene to isophthalic acid; *o*-xylene plus *m*-xylene to *p*-xylene; various raw materials to isoprene; and terephthalic acid to dimethyl terephthalate.

30
Shell Oil Co.
30 Rockefeller Plaza
New York 20, N. Y.

The official reply of Shell processes available for license was not received in time for publication. However, it is known that the new Shell gasification process is now being offered under license to the petrochemical industry.

This process is based on continuous noncatalytic partial oxidation of petroleum fuels and it produces a water gas suitable as a starting material for chemical synthesis of ammonia, methanol, etc.

It is also well known that the Shell Development Co. process for oxygen-oxidation of ethylene to produce ethylene oxide is available for license.

31
Stearns-Roger Mfg. Co.
662 Bannock
Denver, Colo.

In reply to your specific questions, here are the petrochemical processes for which we at Stearns-Roger feel we have special experience and engineering qualification. Design experience in nitrogen derivatives, including synthetic ammonia, urea, nitric acid, ammonium nitrate, ammonium sulfate and complex fertilizers.

One of our latest concepts of process development relates to improved methods for acetylene manufacture. Our experience includes partial oxidation of hydrocarbons; thermal processes used to produce both acetylene and ethylene; and generation of carbide acetylene.

Stearns-Roger has also contributed as designer or engineer-contractor on plants for halogenated hydrocarbons, alkyl boranes, resorcinol and organo-metallics. The company can supply know-how on the purification and rectification of complex mixtures of aromatic hydrocarbons. We have designed and built plants for sulfur recovery from hydrocarbon gases; oxidized hydrocarbon mixtures of aldehydes, ethers and alcohols; production of narrow boiling-range hydrocarbon fractions from complex LPG mixtures.

We maintain a competent technical staff and adequate facilities to undertake the complete development of special processes. We have built chemical plants which use the process designs of others, including installations for producing ethylene glycol, polyethylene, methyl vinyl pyridine.

Stearns-Roger can supply to any customer practically all of the licensed petrochemical processes, either foreign or domestic, that are available on a nonexclusive basis. We are experienced in the negotiating of rights for these processes and have a substantial record in this connection with licensed catalytic processes.

32
Tellepsen Petro-Chem Constructors
P. O. Box 2536
Houston 1, Tex.

In connection with our parent company, Tellepsen Construction Co., with our subsidiary companies in Mexico City and Calgary, and with our affiliated company in Maracaibo, Venezuela, we offer the following services: licensing of process know-how; ad-

40
Company Name

Identification numbers given above company names are used to key process listings in the chemicals index, which starts on p. 157.

visory and consulting services, process design, mechanical engineering and full-scale plant construction.

We offer engineering design and construction services for these petrochemical processes: methyl vinyl pyridine, petroleum resins, polybutadiene-acrylonitrile elastomers; polyvinyl chloride, polyvinyl chloride resin, sulfur, hydrogen sulfide and for various synthetic rubbers.

Also, we offer engineering and design for these petrochemical processes: butadiene, butylene-1, butylene-2, methanol, miticides, polyesters, styrene, triethylene glycol.

We can provide construction services for acetylene, chlorinated solvents and for vinyl chloride plants.

33
Texaco Development Corp.
135 East 42nd St.
New York 17, N. Y.

Texaco will license certain processes that have been developed by Texaco Development Corp. or its parent company, The Texas Co., independently or in conjunction with others.

For example, the Texaco partial oxidation process for making synthesis gas is available either from The Texas Co. or from several engineering and construction companies.

34
Union Oil Co. of California
Union Oil Building
Los Angeles, Calif.

Union Oil has two processes which are available for licensing: the Unifining process for treating the products of coal-tar distillation, etc.; and Hypersorption, a process for separating light hydrocarbon gases. The Unifining process is licensed in conjunction with Universal Oil Products Co.

35
Universal Oil Products
30 Algonquin Road
Des Plaines, Ill.

It is difficult to decide on a rigorous definition of what is and what is not a petrochemical process. Processes listed below are some of those that are offered for licensing by UOP, and that may be considered to be of a petrochemical nature.

Platforming, a catalytic reforming for production of aromatics such as benzene, toluene and xylene from naphtha feeds. Penex, a catalytic isomerization process for converting straight-chain pentanes and hexanes into iso-compounds. Two-stage Unifining, high-severity thermal cracking for processing crude coal-tar light oil aromatics and aromatic condensates which are byproducts of ethylene production. Diolefins and olefins are selectively hydrogenated while nonhydrocarbon impurities are decomposed.

Also, Molex separation of isoparaffins via molecular sieves. Udex process for the recovery of chemical-grade aromatics via solvent extraction. Catalytic condensation for producing specialty polymers of light olefins. Also for synthesizing alkyl aromatics, for example ethyl benzene or cumene; and for manufacture of styrene, acetone and phenol; propylene polymerization to products rich in C_6, C_9 and C_{12} olefins for detergent manufacture.

And, catalytic dehydrogenation for producing butylenes from corresponding paraffins for further conversion; for dehydrogenation of olefins to diolefins for synthetic rubber, plastics manufacture; for dehydrogenation of alkyl aromatics, such as ethyl benzene, to corresponding aromatic olefins (such as styrene) in synthetic rubber, plastic manufacture. Olefin extraction process for butylene recovery. This process separates olefins and diolefins from paraffins using methanol solvent extraction to prepare olefins for further conversion.

We also offer the Hydrar process for converting benzene to cyclohexane of high purity for nylon manufacture. Arosorb selective adsorption for removal of heavier aromatics from synthetic and natural distillates. Alkar process for production of ethyl benzene, cumene, other related aromatics. And the Butamer process which is a catalytic isomerization *n*-butane to isobutane.

36
Vulcan-Cincinnati, Inc.
120 Sycamore St.
Cincinnati 2, Ohio

Vulcan-Cincinnati is particularly well qualified to supply engineering know-how for the following areas of chemical and petrochemical processing. Organic synthesis of methanol, ethanol, propanols, butanols, formaldehyde, acetaldehyde, acetic acid, esters, ethers, glycols, ethylene oxide and urea. Petrochemical processes for the refining of ethylene, butadiene, benzene, heptane, toluene, styrene and diphenyl and chlorinated hydrocarbons. Also, separation of low-molecular-weight hydrocarbons. Distillation, recovery, separation and purification of alcohols, aldehydes, organic acids, furfural, methyl ethyl ketone and other petrochemicals.

In the licensing of processes, Vulcan has important experience, as exemplified by the well-known Inventa-Vulcan processes for methanol synthesis and urea synthesis. Process searches by Vulcan indicate that other processes, both foreign and domestic, could be supplied by Vulcan under the right circumstances to the right customer. We are not at liberty to make a public identification of these processes, however; to do so would compromise Vulcan's relationships with other companies in this regard.

A partial listing of Vulcan's specific petrochemical experience has been included in the chemicals index on p. 157. Look for number **36**.

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Fast, Convenient Approach to Sizing Heat Exchangers

Quick and easy but neglected technique: E-NTU—correlates heater efficiency and number of transfer units; permits fast evaluation of changes in operating conditions; avoids trial-and-error and log-mean temperature calculations.

JOHN R. CARY, Aerojet-General Corp., Sacramento, Calif.

A QUICK technique for heat transfer calculations, known as the *E-NTU* method, seems to have had surprisingly little publicity.

But it is a very useful tool for estimating heat-exchanger performance. While it probably dates back to Nusselt, relatively little discussion was available until Kays and London, and Giedt published their thorough treatments.*

Basically the method involves expressing heat transfer effectiveness or efficiency E, in terms of thermal capacity of the two fluids $R = C_{min.}/C_{max.}$, and a dimensionless term called Number of Transfer Units, NTU, which equals $AU/C_{min.}$. Here U is the over-all coefficient in Btu./(hr.) (°F.) (ft.²); A is the heat-transfer area in sq. ft.; and C_{min} is the smaller of the two thermal capacity rates, Btu./(hr.) (°F.).

Usually E is plotted against NTU with R as the parameter. In sizing heat exchangers, these charts have a number of advantages over the usual log-mean-temperature calculation technique.

First, it isn't necessary to make a mean-temperature-difference calculation. But a more important advantage comes in when studying effect of variations in inlet temperatures on the performance of an existing design. Use of a mean-temperature difference requires trial-and-error since the solution must conform to the energy balance equation. But with the *E-NTU* technique, E remains essentially constant for many applications, and the effect of revised temperatures can be determined immediately.

By reviewing the principles of *E-NTU* here, we hope to develop a more general appreciation of its convenience.

What's Behind Method

In heat exchanger design, local heat flux varies from one element of area to the next primarily because of varying thermal potential. When the over-all coefficient U is constant, the differential form of the rate equation is

$$dQ/dA = U(T_h - t_c) = U\theta$$

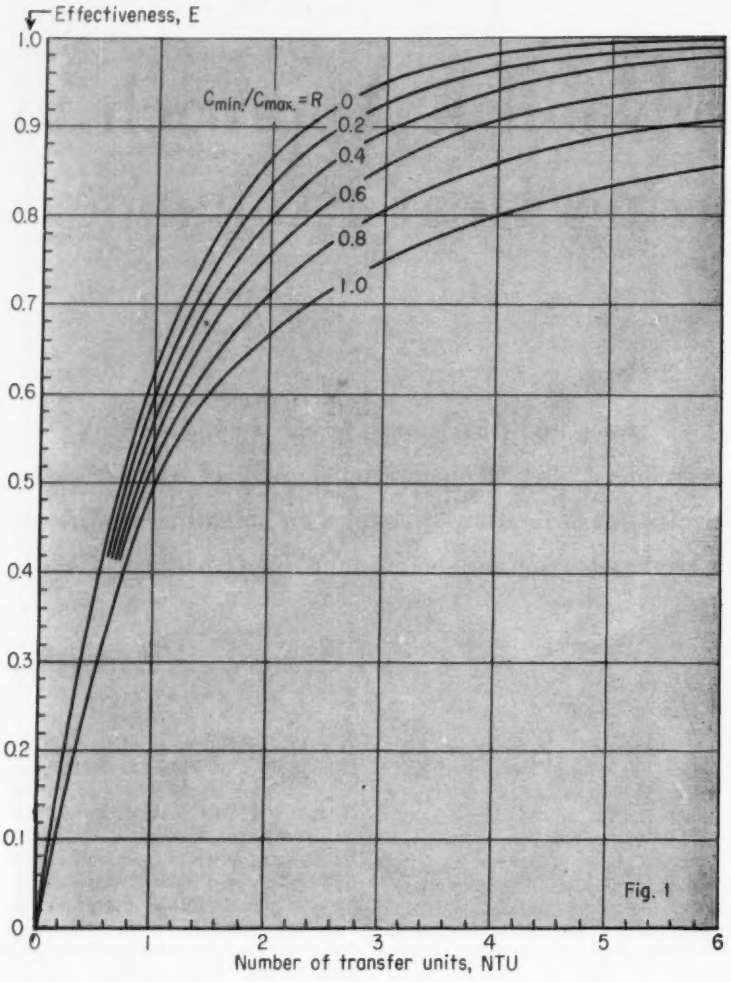
A heat balance equation for the two fluids also applies: $dQ = \pm C\,dt$, where C is the thermal capacity rate wc_p, Btu./(hr.) (°F.) for example. Choice of algebraic sign depends only on the direction of fluid flow referred to the defined direction of area increase. After selecting appropriate signs, the rate equation may be combined with the heat balance equations to eliminate dQ. Now let's consider a counterflow design.

Assume first that fluid properties remain constant (the case of variable fluid properties will be examined later). Mass flow rates will be assumed constant, as well as the criterion of a loss-free heat exchanger. Finally, temperature of the hot fluid will be defined as decreasing in the direction of area increase. Referring to the hot and cold fluids with capital and lower case letters respectively, elimination of dQ yields

$$\int_{T_{in}}^{T_{out}} \frac{d(T-t)}{(T-t)} = \int_0^A -U\left(\frac{1}{C} - \frac{1}{c}\right)dA$$

* Kays, W. M. and A. L. London, "Compact Heat Exchangers," McGraw-Hill Book Co., (1958).
Giedt, W. H. "Principles of Engineering Heat Transfer," D. Van Nostrand Co., (1957).

Effectiveness of Counterflow Exchangers



Note that existence of a thermal potential at every section in the heat exchanger is implied. Performing integration and employing the exponential form

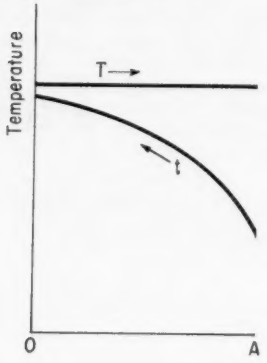
$(T_{out}-t_{in})/(T_{in}-t_{out}) = e^{-U[(a/C)-(a/c)]A}$

Identity of this form with the log-mean-temperature difference can be established if you take the logarithm of both sides and perform elementary algebraic operations. However, a different arrangement yields a design equation of great flexibility and convenience. To arrive at this new arrangement, let's first consider performance in terms of limiting conditions.

Heat Exchanger Effectiveness

Either of two possible limiting cases of performance exist for all heat exchangers: (a) $C >> c$, and (b) $c >> C$, sketched in Fig. 2. Temperature of the fluid of smaller capacity will asymptotically approach temperature of the fluid of greater thermal capacity. This maximum temperature rise represents the maximum heat transfer. Absolute theoretical limit is $Q_{max.} = C_{min.}(T_{in} - t_{in})$ in both cases, where $C_{min.}$ is the smaller of the two capacities (either the capacity of the hot fluid, or the cold fluid). However, the theoretical limit is not achieved in practice.

Hot Liquid is Limiting Factor



It is logical to form the ratio (Q transferred)/(Q maximum) as a measure of performance. This ratio is called heat transfer effectiveness, and two cases may be distinguished. When a unit is designed primarily to cool a fluid, a "cooler effectiveness" is advantageous:

$$E = \frac{C_{hot}\,(T_{in} - T_{out})}{C_{min.}\,(T_{in} - t_{in})}$$

In other cases a "heater effectiveness" is preferable:

$$E' = \frac{C_{cold}\,(t_{out} - t_{in})}{C_{min.}\,(T_{in} - t_{in})}$$

Identity of these two definitions may be shown by using the heat balance equation $C\Delta T = c\Delta t$, and thus the question may occur as to why a distinction is necessary. The reason is the concept of effectiveness should be general. If, for example, condensing vapor is used to heat a fluid medium, then the specific heat of the vapor can be considered as infinite. But no temperature change takes place. Thus, the numerator of the definition for E takes the indeterminate form $\infty \times 0$, whereas the definition of E' will give a real number.

Form of the definitions is especially convenient for practical reasons. For example, in designing a cooling unit, inlet temperature T_{in}, temperature of the available coolant t_{in}, and unit thermal capacity rates will be given. A required discharge temperature T_{out} will be specified. It is these three temperatures which

Cold Liquid Is Limiting Factor

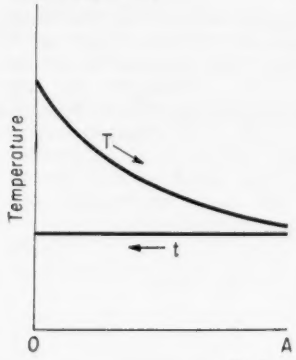


Fig. 2

Effectiveness of Parallel-Flow Exchangers

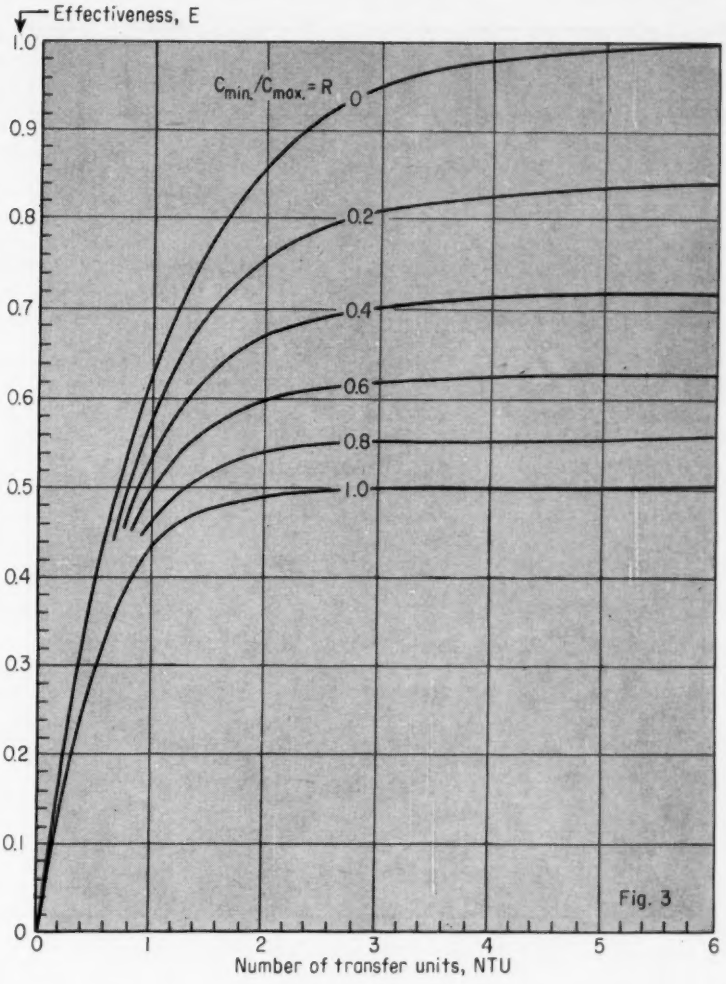


Fig. 3

appear in the definition of effectiveness, and we will show that effectiveness can be expressed in terms of U, A, and the ratio of thermal capacity rates.

Avoid This Trap

A special case of E may be anticipated. If, for a series of designs, $C < c$ always, then $C_{hot} = C_{min.}$, and the definition above may be simplified to a temperature effectiveness. However, be sure you use the temperature effectiveness only for this situation. A coolant of small capacity will do some cooling, and may, in fact, be adequate to sustain the design heat load in particular cases. In other cases, the coolant capacity may be so small as to pose a physically impossible problem, and this will not be apparent from the special definition of E. For this reason, unless it is an invariable policy to design a cooler for the condition $C_{hot} = C_{min.}$, the more general definition is recommended.

The existence of a minimum capacity rate $C_{min.}$ implies existence of a maximum capacity rate $C_{max.}$ By establishing the ratio $C_{min.}/C_{max.} = R$, all possible cases are accounted for $(0 \leq R \leq 1)$. Convenience of this will become evident. With these two ideas in mind, let's redirect our attention to the design equation.

Area Requirements

By appropriate substitutions using the heat balance equation, the definition of effectiveness and the ratio R, it's possible to write the design equation in the form

$$\frac{1 - E}{1 - RE} = e^{-(1-R)\,(UA)/C_{min.}}$$

This equation holds irrespective of which of the two thermal capacity rates is larger, provided that E and R are defined as above.

An interesting quantity has appeared here, $(UA)/C_{min.}$ By writing $A/C_{min.}/U$, ie, transfer area/(maximum capacity to absorb/unit capacity to transfer), it becomes evident that $(UA)/C_{min.}$ is roughly minimum transfer area required per unit performance. This dimensionless quantity is called the Number of Transfer Units, abbreviated *NTU*.

Important Design Equations

In final form the design equation for a counter-flow heat exchanger becomes

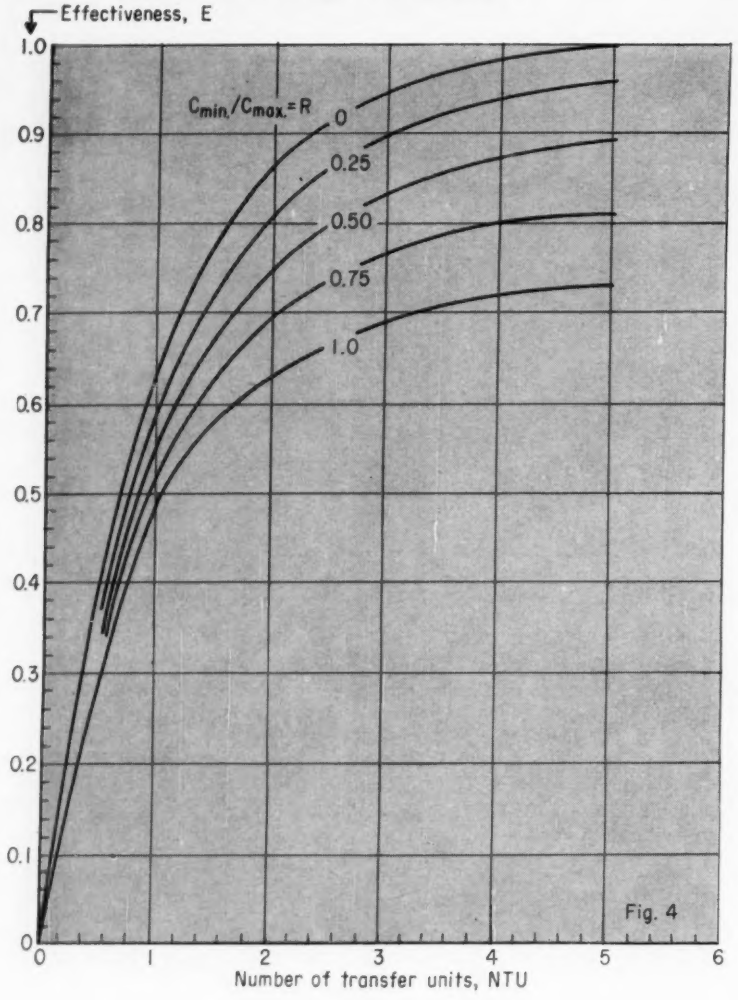
$$\frac{1 - E}{1 - RE} = e^{-(1-R)\,NTU}$$

and the equivalent expression for parallel flow is

$$1 - E - RE = e^{-(1+R)\,NTU}$$

Results for other flow geometries; crossflow, multipass, and others, may be found in the thorough treatment of Kays and

Effectiveness for 2-4 Multipass Counterflow



London. Design charts for counterflow and parallel flow are shown in Figs. 1, 3 and 4.

A special case is of interest. When $R = O$, as for a unit employing a condensing or an evaporating fluid, the design equations reduce to

$$E = 1 - e^{-NTU}$$

and, in fact, it may be shown that this simple form applies to all heat exchangers, however complicated the flow geometry, where $R = O$. This form is particularly illustrative, since it shows the $E \rightarrow 1$ only when $NTU \rightarrow \infty$. Because both U and $C_{min.}$ will be finite, an effectiveness of one clearly can be realized only in an exchanger of infinite area. Since an effectiveness of unity occurs with a zero approach temperature, $T_{out} = t_{in}$, an infinite area is required to get theoretical maximum heat transfer, and $E < 1$ in the practical case.

The maximum limit on R is another special case. When $R = 1$, the counterflow and parallel flow expressions respectively become

$$E_{C.F.} = \frac{NTU}{1 + NTU}$$

$$E_{P.F.} = \frac{1 - e^{-2NTU}}{2}$$

As the area of the counterflow heat exchanger increases, effectiveness approaches unity; for the parallel flow unit, the asymptotic effectiveness is 0.50. In reviewing the limiting conditions $R = 0$ and $R = 1$, note there is no difference between heat exchangers for the former condition. When $R = 1$, however, a high effectiveness is possible only with a counterflow unit. Other types of flow geometries will show intermedate performance characteristics.

Work an Example

As a numerical example, assume that it is required to cool M lb./hr. of material of specific heat 0.50 Btu./(lb.) (°F.) from 300 F. to 150 F. Water is available as a coolant at $2M$ lb./hr., and 60 F. The overall coefficient is 100 Btu./hr.) (ft.)^2 (F). A counterflow unit is to be designed. (Note that in this case, $C_{hot} = C_{min.}$).

$$E = \frac{(300 - 150)}{(300 - 60)} = 0.625$$

$$R = \frac{0.50\ M}{1.00\ (2M)} = 0.25$$

$$NTU = 1.06 = \frac{UA}{C_{min.}} \text{ From Fig. 1}$$

$$\frac{A}{M} = \left(\frac{UA}{C_{min.}}\right)\left(\frac{C_{min.}}{U}\right) =$$

0.0053 ft.^{2}/(lb.)/hr. of M

Note that it is especially convenient to determine influence of reduced coolant temperature applied to the design: if the coolant were available at 50 F. instead of 60 F. then

$$\frac{300 - 150}{300 - 60} = \frac{300 - T'_{out}}{300 - 50}$$

$$T'_{out} = 144\text{F.}$$

If the original exit temperature $T_{out} = 150$F. is to be maintained, a new area can be easily computed.

Series Heat Exchangers

The occasional requirement to employ two or more heat exchangers in series is particularly adaptable to this method of treatment. In this case, use arrangement of temperatures obtained directly from the integration. In terms of R and E, again using the case of counterflow as a specific example,

$$\frac{1 - E}{1 - RE} = \frac{T_{out} - t_{in}}{T_{in} - t_{out}}$$

Referring to the sketch in Fig. 5, form the product

$$\left(\frac{T_1 - t_1}{T_{in} - t_{out}}\right)\left(\frac{T_2 - t_2}{T_1 - t_1}\right)\left(\frac{T_{out} - t_{in}}{T_2 - t_2}\right) = \frac{T_{out} - t_{in}}{T_{in} - t_{out}}$$

or

$$\left(\frac{1-E_1}{1-RE_1}\right)\left(\frac{1-E_2}{1-RE_2}\right)\left(\frac{1-E_3}{1-RE_3}\right) = \frac{1-E}{1-RE}$$

The equivalent expression for parallel flow is

$$(1-E_1-RE_1)(1-E_2-RE_2)(1-E_3-RE_3) = (1-E-RE)$$

These may be illustrated by assuming $R = O$ and $E_1 = E_2 \ldots E_n$, so that for both parallel and counterflow,

$$E = 1 - (1 - E_1)^n$$

As expected, if E_1 is already large, little additional performance is gained by additional units. If E_1 is small, several units in series will be required to realize a high aggregate performance, and it may be better simply to obtain a new unit of increased individual performance.

In the numerical example cited, two such units would yield a combined performance

$$\left[\frac{1-0.625}{1-(0.625)(0.25)}\right]^2 = \frac{1-E}{1-0.25E} = 0.198$$

$$E = 0.845$$

$$T_{out} = 97 \text{ F.}$$

What About Variable U?

A variation in fluid properties is frequently shown up as a variation in the over-all coefficient U. Heat exchangers handling petroleum fractions are an example. Even for relatively modest changes in oil temperature, the viscosity may change by an order of magnitude or more, with a proportional change in the oil-side coefficient. When the oil-side thermal resistance is a major fraction of the total, a large change in U can occur.

Very little attention seems to have been given to applying the *E-NTU-R* parameters when U is not constant. The solution for a general variation in U involves integrals of the form $\int dx/xf(x)$, and except for some special cases, the integral becomes so complicated as to be impractical. However, one of the special cases—linearity between U and θ—can be presented quite simply in the form of a correction on the case of constant U.

Since it is always possible to approximate linearity over a narrow range of θ, even a nonlinear relationship can be treated as a succession of linear approximations approached in a succession of subdivisions.

The over-all coefficient may be arbitrarily defined $U = U_{max.}\ (a + b\ \theta)$. Values of a and b may be obtained by imposing the conditions that $U_{max.}$ occurs at $\theta_{max.}$, and $U_{min.}$ occurs at $\theta_{min.}$. Only a will be of interest subsequently, and it will be found to be

$$a = \frac{(U_{min.}/U_{max.}) - (\theta_{min.}/\theta_{max.})}{1 - (\theta_{min.}/\theta_{max.})}$$

Following the some procedure as in the case of constant U, the design equation becomes

$$\left(\frac{1 - E}{1 - RE}\right)\left(\frac{U_{max.}}{U_{min.}}\right) = e^{-(1-R)\ (U_{max.}\ A/C_{min.})\ a}$$

It will now be convenient to restrict the definition of NTU, thus

$$NTU = (U_{max.}\ A)/C_{min.}$$

and to attribute to this a performance E_0. This is the performance of a unit of constant $U_{max.}$, and therefore

$$\frac{1 - E_0}{1 - RE_0} = e^{-(1-R)\ AU_{max.}/C_{min.}} = \psi_0$$

After rearranging the design equation, the result becomes

$$\psi_0 = [\psi/(U_{min.}/U_{max.})]^{(1-\psi)/[(U_{min.}/U_{max.})-\psi}$$

where

$$\psi = \frac{1 - E}{1 - RE}$$

In the case of constant U, simplification leads to an identity.

The same form of expression relating ψ and ψ_0 applies for parallel flow except that $\psi = (1\text{-}E\text{-}RE)$. Here a word of caution may save labor at some future time. For parallel flow, the limiting value of ψ is $1/(1 + R)$, which occurs for infinite NTU (therefore area). For this reason, a plot of ψ vs E for parallel flow need never consider negative values of ψ, which would be mathematically possible for the condition $E > 1/(1 + R)$.

The relationship between ψ_0 and ψ is shown in Fig. 6.

Go Through a Problem

To show how these results may be applied, the previously used example with be modified to the case of variable U. Suppose that U calculated for different temperature levels varies as shown in the table below:

T oil	t coolant	θ	U
300	97.5	202.5	100
225	78.8	146.2	70
150	60	90	60

Exchangers in Series Offer Some Benefits

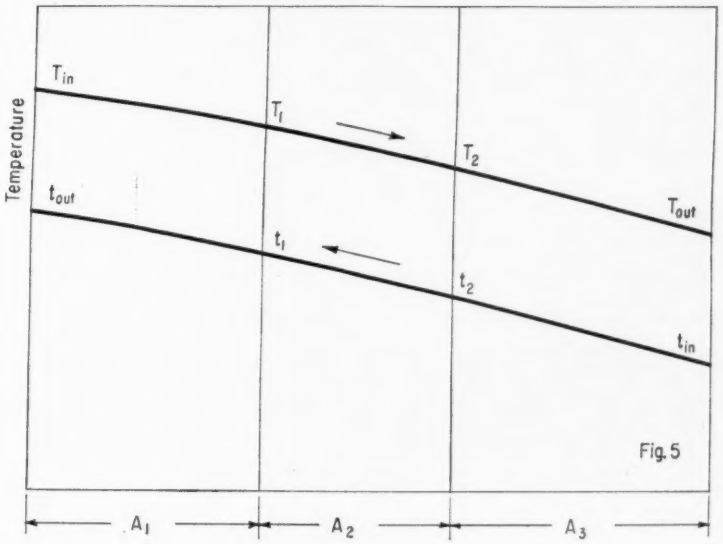


Fig. 5

Even a rough sketch will show that U is not linear with θ over the specified range. But two different linear approximations for $146.2 \leq \theta \leq 202.5$ and $90 \leq \theta \leq 146.2$ represent the variation in U reasonably well. With the unit divided into two sections, calculations can be made:

Section 1: $T_{in} = 300$; $t_{in} = 78.8$; $T_{out} = 225$; $R = 0.25$

$$E = \frac{300 - 225}{300 - 78.8} = 0.340$$

$$U_{min.}/U_{max.} = 70/100 = 0.70$$

$$\psi = \frac{1 - 0.34}{1 - (0.25)\ (0.34)} = 0.722$$

$\psi_0/\psi = 0.94'$ (Fig. 6)

$\psi_0 = 0.68$

$$\frac{1 - E_0}{1 - RE_0} = 0.68,$$

$E_0 = 0.391$

$(A\ U_{max.})/C_{min.} = 0.57$; (Fig. 1)

$$\frac{A}{M} = \frac{(0.50)\ (0.57)}{100} = 0.00285$$

Section 2: $T_{in} = 225$; $t_{in} = 60$; $T_{out} = 150$; $R = 0.25$

$$E = \frac{225 - 150}{225 - 60} = 0.455$$

$$U_{min.}/U_{max.} = 60/70 = 0.857$$

$$\psi = \frac{1 - 0.455}{1 - (0.25)\ (0.455)} = 0.627$$

$\psi_0/\psi = 0.95$ (Fig. 6)

$\psi_0 = 0.602$

$$\frac{1 - E_0}{1 - RE_0} = 0.601,\ E_0 = 0.470$$

$(A\ U_{max.})/C_{min.} = 0.73$; (Fig. 1)

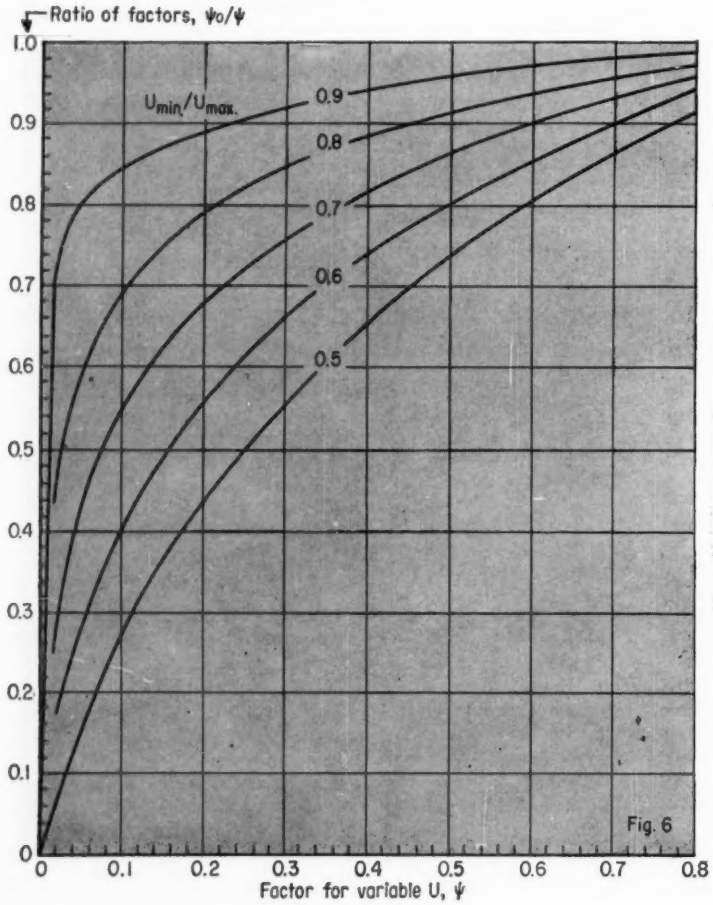
$$\frac{A}{M} = \frac{(0.50)\ (0.73)}{70} = 0.00521$$

$$\text{Total } \frac{A}{M} = 0.00521 + 0.00285$$

$= 0.00806$ ft.²/lb. per hr. of M

A little thought will suggest that the reason for the appreciably greater area is that the already small heat flux at small temperature potentials was aggravated by the reduced local coefficient.

How to Account for Variable U



Compare With Other Solutions

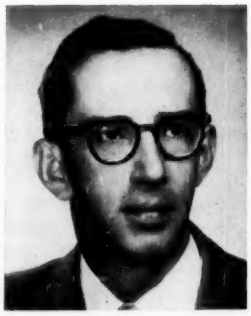
Results of other calculations are shown for purposes of comparison:

(a) $U = (U_{max.} + U_{min.})/2 = 80$ (a constant): $A/M = 0.00675$;

(b) $U = 70$, a judicious guess: $A/M = 0.00773$;

(c) General variation of U, obtained by numerical integration: $A/M = 0.00810$

In the illustrative example, use of only two sections yields a result which is probably as accurate as the basic data justify. The convenience and speed of the method is obvious. The design charts are such that even a relatively untrained aide can be assigned the task of heat exchanger design.



JOHN R. CARY *is supervisor of test coordination and analysis on the Polaris project at Aerojet-General. A mechanical engineer (M.S. from Purdue) long interested in heat transfer problems, he worked on aircraft heat and cooling problems (Douglas), on nuclear cooling (Calif. Research and Dev. Co.) and on special heat transfer projects (AiResearch Mfg. Co.) before joining Aerojet.*

With fixed stator blades, axial compressors lose efficiency at less-than-rated capacities; using adjustable stator blades, such as these movable guide vanes, maintains performance superior to the centrifugal.—Fig. 4

Control of Axial Compressors In Variable-Capacity Service

ROBERT E. CLAUDE, Allis-Chalmers Mfg. Co., New York, N. Y.

MODERN axial compressors can provide a profitable solution to a wide range of air- or gas-handling problems. As recently as a few years ago, however, before the development of adjustable stator blades, the inherent steep performance curve of an axial compressor could at times cancel out some of its advantages if extreme capacity variations were needed.

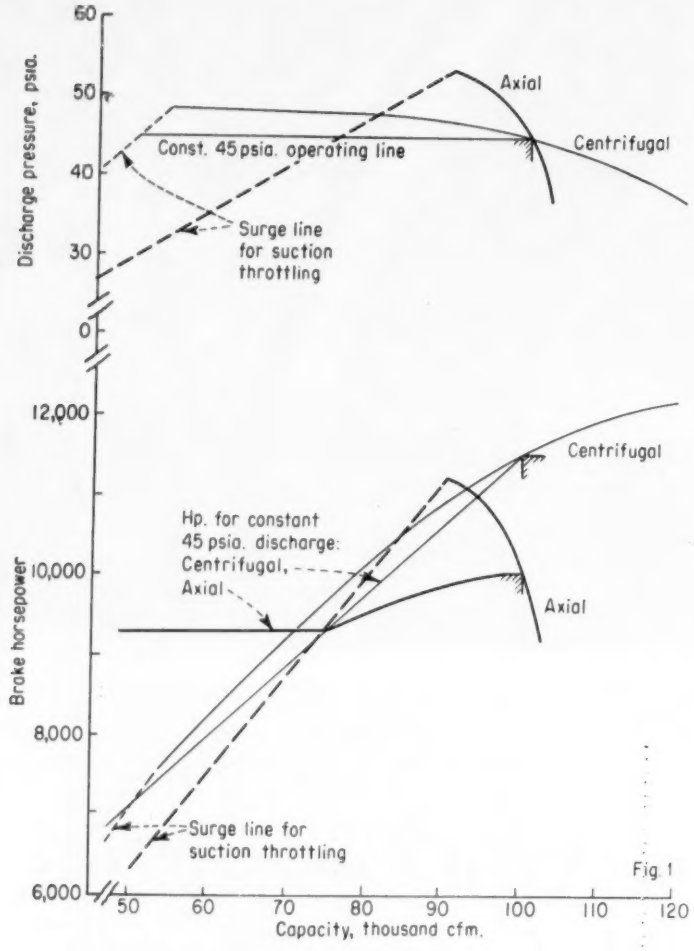
Like all other types of air and gas compressors, the axial compressor is designed to operate at a specific set of conditions. For an axial compressor, however, any variation from these conditions, particularly in capacity, is somewhat limited due to its characteristic performance curve.

On this account, part-load points have to be obtained by variable speed, blow-off, bleed-in, recirculation or a combination of these methods. And in cases of a constant-speed driver where an extreme amount of blow-off, bleed-in or recirculation would usually be necessary, the efficiency advantage of an axial compressor could very easily be nullified. This is shown in Fig. 1.

How Compressors Compare

Assume that both a centrifugal and an axial compressor are identically rated at 100,000 cfm. inlet at 14.4 psia. and 100 F., with a discharge pressure of 45 psia. Note from the lower diagram of Fig. 1 that, at this rated point, the centrifugal would require 11,500 bhp. while the axial would need only 10,000 bhp., almost 13% less.

Assume, now, that the process calls for operation at 45 psia. and capacity variation all the way from the rated 100,000 cfm. to 50,000 cfm., using a constant-speed driver. Capacity variation is to be obtained by throttling the suction on both machines. This will then give the two horsepower curves for operation at 45 psia. constant discharge pressure shown in Fig. 1. It is easy to see how the efficiency advantage of the axial is nullified as capacity is reduced at constant discharge pressure.



Brake horsepower and discharge pressure of axial and centrifugal compressors with throttled suction.—Fig. 1

At 80,000 cfm., for instance—even though this point is still contained in the envelope of both machines and no recirculation or blow-off is necessary—the horsepower required for the axial is about 9,500 and, for the centrifugal, about 9,750. Consequently, the efficiency advantage of the axial here is only 3%.

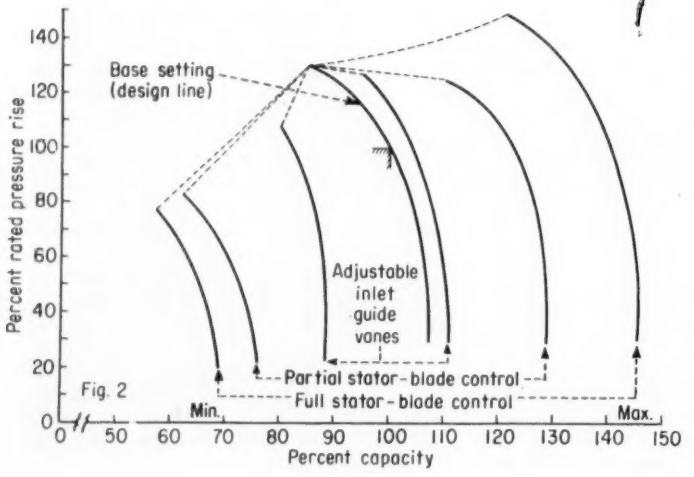
At 75,000 cfm. both machines require the same horsepower; from there on the centrifugal requires less until, at 50,000 cfm., the axial takes 9,300 hp. and the centrifugal 7,050. Now, the centrifugal is over 24% more efficient than the axial. Also at the 50,000 cfm. and 45 psia. point, 25,000 cfm. must be blown off or recirculated for the axial while no air need be relieved for the centrifugal.

These differences in power requirements are never really important if this sort of variable-capacity operation is infrequently needed. However, if normal operation should call for the use of part-capacity points for substantial lengths of time, it would pay to have the centrifugal, even though the installed horsepower of the driver had to be larger.

Overcoming the Disadvantages

With the advent of adjustable stator blades for the axial compressor, this disadvantage has been overcome. Adjustable stator blades are used in three different ways: (1) as adjustable inlet guide vanes only; (2) applied to several stages for partial stator-blade control; or (3) applied to all stages for full stator-blade control. Fig. 4 shows the first of these, and Fig. 5, the last.

Fig. 2 shows the relative range coverage for each of the three methods, based upon a common design point. As this diagram shows, at 100% of pressure rise, adjustable inlet guide vanes give approxi-



Effect of three methods of control on axial compressor performance.—Fig. 2

mately a 20% range of capacity adjustment. Partial stator-blade control gives about 40% and full stator-blade control nearly 50%.

Going back to Fig. 1, assume the axial compressor to be equipped with partial stator-blade control. This implies that about half the stages, starting with the inlet end, will be adjustable. Since the capacity variation required is in a decreasing direction, the maximum curve for partial control (Fig. 2) is placed on the rated point. A constant 45 psia. bhp. curve is then drawn and Fig. 3 shows the result.

Note that at the rated point (100,000 cfm.) the horsepower for the axial compressor has increased only slightly due to the very slight efficiency decrease from off-design-point operation. If the design point which lies on the base line (upper chart, Fig. 3) had been placed on the rated point, the horsepower would have remained at 10,000 as before. In other words, the envelopes obtainable from these methods of control can be juggled to fit the application in almost any manner. This is possible because, for the same pressure rise, the efficiency anywhere in the envelope varies very little from the base-settings peak efficiency for the particular pressure rise.

At 80,000 cfm., in Fig. 3, the horsepower for the axial is 8,000 which is 15% lower than for the centrifugal. At the 50,000 cfm. point, the horsepower figure is 6,000, 18% lower than for the centrifugal with suction throttling and 14% lower than for the centrifugal with adjustable inlet guide vanes. In this case, suction throttling was not used for the axial. The stator blade settings were simply changed while the machine was operating.

Fig. 3 shows both suction throttling and adjustable inlet guide vanes as practical for the requirements of the centrifugal. And, by using one of the adjustable stator blade methods in this case, the inherent efficiency advantage of the axial was maintained. The axial compressor's advantages of smaller size and less installed horsepower, with its smaller foundation and building costs, are also evident.

How Blade Control Works

Another advantage of adjustable stator blades is that the mechanism is of a very simple and trouble-free construction. Fig. 4 shows a typical construction for a machine having adjustable guide vanes only. The same method and type of construction applies also to the adjustable blades used for partial and full stator-blade control.

Each blade is inserted through a hole in the cylinder liner and is fastened rigidly to a lever. The other end of the lever has a U-shaped slot which rides on a bushing fastened to a large bull ring encircling the cylinder liner. Each blade of the row is connected in this manner.

For easy movement, and to prevent any binding under load, the bull ring rides on rollers mounted in slots in the ring. Rotation of the bull ring in either direction will then decrease or increase the angle of attack of the blades. With full or partial stator-blade control, all the movable bull rings are usually tied together so they will move at one time. Fig. 5 shows an axial compressor with full stator-blade control. Occasionally, as discussed later, the several bull rings will be individually controlled.

Several methods can be used to move the bull ring—or rings—to vary angle of attack and so change the capacity. The simplest method is with a handwheel on the side of the casing connected through gear-

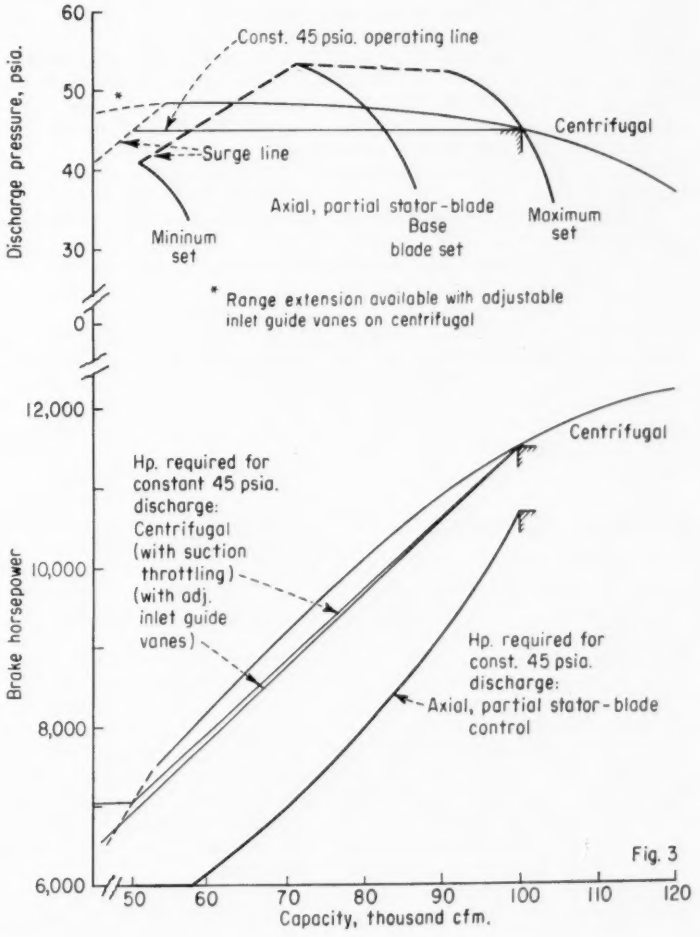
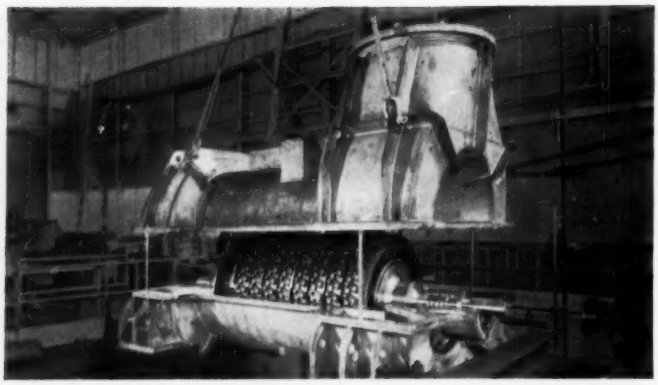


Fig. 3

Axial with partial stator-blade control compared with centrifugals.—Fig. 3



Nine-stage axial compressor has full stator-blade control.—Fig. 5

ing to the bull rings. Movement of the bull rings may also be accomplished by hydraulic cylinders, or by electric motors through gearing. With these latter methods, the action of the hydraulic cylinders or electric motors can be controlled manually by a selector switch and position indicator from a remote subpanel. If desired, they can also be tied directly into the process so that capacity will change automatically as process demands change.

If further reductions in capacity are needed beyond those possible with the adjustable-stator method used, additional control methods such as blow-off, bleed-in, inlet throttling or recirculation, or combinations of these, can easily be added. Of course, a far smaller quantity of air or gas will have to be relieved than if the axial did not have some form of adjustable stator blades.

Pattern of Applications

Applications of these three forms of adjustable stator blades usually follow a fairly definite pattern. Where any minor variations in capacity are expected, adjustable inlet guide vanes usually are all that is needed. For example, in one wind-tunnel installation there are five axial machines, each with adjustable inlet guide vanes only. These axials can operate in series or parallel and the adjustable inlet guide vanes allow the necessary matching for series operation without excessive recirculation on the part of any of the machines. They also permit small capacity variations with machines in parallel.

Partial stator-blade control is used where adjustable inlet guide vanes do not give enough capacity variation and the extreme capacity variation of full stator-blade control is not warranted. Such applications would be for blast-furnace duty in steel mills, petrochemical installations and aircraft and engine testing facilities.

Full stator-blade control is the ultimate in control and fits in perfectly where large capacity variation is necessary. Examples are found in the manufacture of oxygen and in some aircraft wind-tunnel work.

At times, applications present themselves where extremely fine control variation is necessary because of frequent operation under conditions that are far off the rated point. Such a condition would be at a low percentage of rated pressure rise. Higher efficiency than normally obtainable is required at these conditions. Yet high efficiency must also be maintained over all the many other combinations of capacity and pressure that the machine must cover.

In a case such as this, individual adjustability of the various rows of blades will be provided, in addition to the normal method of moving all rows together. This method allows for proportional movement of each row, plus ability of each row to be adjusted separately to obtain optimum operation under all conditions.

For this full adjustability a hydraulic cylinder can be fastened to each row of blades and movement of all the hydraulic cylinders individually controlled, with each row having its separate position selector and indicator. Proportional movement or synchronous movement can be accomplished by switching to a master selector, with all the cylinders tied in hydraulically.

A machine of this type eliminated the need for a wound-rotor motor of high horsepower which the customer had thought would be necessary on account of the stringent part-load requirements and extensive operating map. By using the fully adjustable, constant-speed machine, a much less expensive constant-speed synchronous motor was used.

To sum it up, when an axial compressor is desirable because of:

- Need for large capacity
- Need for high efficiency
- Need for the particular characteristics of an axial (e.g., to take advantage of the high pressure available at part-load points, or for paralleling with other types of dynamic machines) or
- Need for efficient capacity variation—then an adjustable-stator-blade-equipped unit can offer a practical and economical answer to almost any air- and gas-handling problem.

R. E. CLAUDE, *author of the section on axial compressors in our June 1956 Report on Handling Compressible Fluids, is a sales representative and application engineer for Allis-Chalmers, recently transferred to the New York office. He has a degree in aero engineering from Parks College of Aero Technology and has worked toward an MBA at University of Wisconsin. He is a holder of USAF's Distinguished Flying Cross and the Air Medal.*

Free—For your files—Check your Reader Service postcard (p. 246) for an extra copy of this article

Rate Phenomena Control Arrangement of Unit Operations

Motivating Potential	Resultant Flow	Primary Resistance	Purpose of Flow	Operation
Mechanical energy	Homogeneous fluid	Within fluid	Transportation	Fluid flow
		External to fluid	Separation	Filtration, sedimentation, etc.
Thermal energy	Heat	Within fluid	Heat transfer	Convection
		Solid external to fluid	Heat transfer	Conduction
		Space geometry	Heat transfer	Radiation
Concentration	Mass	Within fluid	Separation	Absorption, stripping
		Within fluid	Separation	Adsorption
		Within fluid	Separation	Extraction, leaching
		Within fluid	Separation	Crystallization
		Within fluid	Separation	Distillation
	Mass	External	Separation	Gas diffusion
		External	Separation	Dialysis, electrodialysis
Simultaneous thermal and concentration	Heat and mass	Within fluid	Mixing	Humidification
		Within fluid	Separation	Dehumidification
		Within fluid	Heat transfer	Water cooling
	Heat and mass	External, internal or both	Separation	Drying
Chemical				Reaction

Begin Review of Unit Operations

Fundamental know-how and rational analysis are basis of this new refresher series on unit operations.

JESSE COATES and BERNARD S. PRESSBURG, Louisiana State University, Baton Rouge, La.

PURPOSE of this new refresher series is to present the unit operations as a unified whole. By this means, it is hoped that a return to original concepts based on fundamental principles can be achieved. Also, the tendency toward fragmentation in the chemical engineering profession can be shown to be unnecessary and, eventually, may be reversed.

Central theme of this series is that all unit operations are rate phenomena and may be treated as such. Rate processes may be classified in accordance with (1) driving force or motivating potential; (2) nature of the resistance. Rate may be expressed as the ratio of potential to resistance.

We will show that the equilibrium stage or theoretical step results when the net rate of a process becomes zero. Thermodynamically, rate processes must satisfy the first law of thermodynamics and are frequently limited by the requirements of the second law.

We intend to show that most unit operations can be put on a common basis and will present a logical scheme whereby this may be done. Through the use of this concept, it will be possible to analyze present practice better. In addition, this concept allows a simpler and more easily comprehended presentation of the unit operations. This should result in a clearer understanding of

present day technology and should simplify the work of equipment and process design engineers.

New processes and technological advances are made at an ever more rapid rate. Hence, it becomes increasingly difficult for the present day unit operations concept to cope adequately with the new problems imposed upon it. In fact, this same rapid development has caused much of the fragmentation. Thus, we find new unit operations being designated for each new application.

As these developments increase, a tendency appears to depart from fundamentals and to place increasing reliance on empiricism. We, as chemical engineers, are resorting more and more to the cut-and-try method with less tendency to plan or interpret technology in the light of fundamental principles.

There is no quarrel with empiricism that is properly related to fundamentals. But, it seems that the fragmentation and compartmentalization, which have occurred in unit operations, have contributed to this departure from fundamentals.

It is important that these unit operations be brought together in a unified whole.

What Is Basic Rate Equation?

As used in this series, the basic rate equation is given by:

$$\text{Rate} = \frac{\text{Motivating potential}}{\text{Resistance}}$$

Rate will designate flow of mass or energy per unit time under the influence of a motivating potential required to overcome a resistance to flow.

Flow will be used in its general sense to imply motion of matter or energy. Flow may be steady, not changing with time, as in continuous processes; or the rate may be unsteady, varying with time, as in certain batch processes.

In terms of the above equation, rate may be desired for any instant in a process or as the average rate for the over-all process. But the important thing to note is that whether flow is steady, unsteady or constant, it may be evaluated by beginning with the same basic equation.

This evaluation is logically done by (1) recognizing the type of motivating potential which is applicable and calculating its magnitude; and (2) resolution of the resistance into its component parts in order that these may be correctly evaluated and properly combined to obtain the total resistance to flow.

Types of Motivating Potential

A study of the various unit operations shows that four types of motivating potentials are sufficient for handling all of the unit operations. These motivating potentials may be classified according to the nature of the potential as mechanical potentials, thermal potentials, concentration potentials, and chemical potentials.

In many processes only one of these potentials need be considered. However, in other cases two or more of these potentials will exist simultaneously and must be dealt with accordingly. For example, both thermal and concentration potentials are involved in problems dealing with simultaneous heat and mass transfer operations.

It may be argued, with some justification in theory, that concentration differences as a potential can be expressed in mechanical terms such as fugacities or partial pressures. Although this can be done, it is best to consider concentration differences as a separate type of potential. From a practical point of view, conversion of concentration differences to fugacity is sometimes impossible because of lack of data. At best, it is tedious and time consuming. (*Turn page*)

What's Happened to Unit Operations

Unit operations as a concept in chemical engineering were first stated by A. D. Little of M.I.T. about 45 years ago:

"Any chemical process, on whatever scale conducted, may be resolved into a coordinated series of what may be termed 'unit-actions,' . . . The number of these basic unit operations is not very large and relatively few of them are involved in any particular process.

"The complexity of chemical engineering results from the variety of conditions as to temperature, pressure, etc., under which the unit actions must be carried out . . . and from the limitations as to materials of construction and design of apparatus imposed by the physical and chemical character of the reacting substances."

A wide departure from these fundamental ideas has occurred in recent years. Many of the present day practices are completely different from and even diametrically opposed to the early ideas.

Thus, there has been a decided tendency toward branching and fragmentation of the unit operations such that many of the present day ideas are no more than illusionary distortions of the fundamental premises.

One approach treats unit operations as though they were completely separate subjects with each operation enclosed in a compartment, and provided with its own special set of formulas. This compartmentalization is not only unnecessary but is also a detriment to development of the profession.

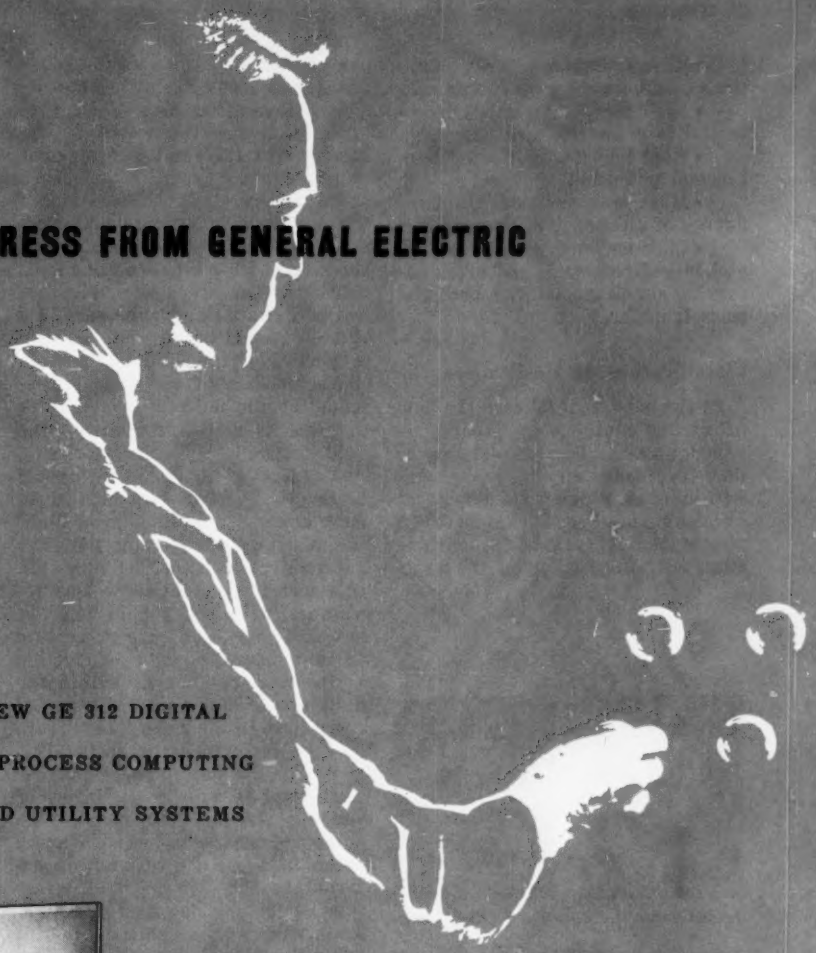
Compartmentalization, bifurcation and fragmentation within the chemical engineering profession have been the target of many critics. They have shown many of these developments to be unnecessary and undesirable. This problem has been attacked from many angles and with several different plans of action.

One of these plans recognizes that present day engineers will be required to know more of fundamental science. Further, almost all chemical engineering, including all of the unit operations, can and should be based on fundamental scientific principles rather than empiricism. It is the extent and degree of emphasis of pure science as opposed to engineering science which causes most differences of opinion.

In brief, the science-engineering approach is based on the premise that most chemical engineering problems can be solved by an application of the first and second laws of thermodynamics aided by the rate equations. According to this idea, the energy and material balances and the equilibrium balance combined with kinetic consideration will answer most engineering problems.

We are in general agreement with this proposition and many of these same ideas will be covered in this refresher series. However, we differ primarily in points of emphasis. We urge a return to the original concepts and will demonstrate that these are still consistent with the modern approach to chemical engineering.

COMPUTER PROGRESS FROM GENERAL ELECTRIC



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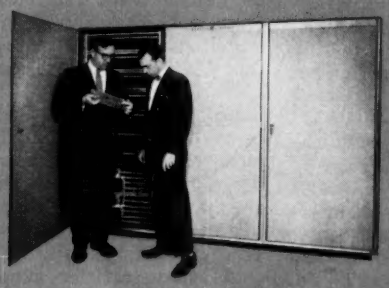

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FOR FIGURES IN A HURRY—FIGURE ON A GE COMPUTER

CPA-10 (5-59)

Common examples of unit operations involving these potentials are:

- Fluid flow in which the potential is primarily mechanical.
- Heat transfer motivated by a thermal potential.
- Mass transfer under the influence of a concentration gradient.
- Chemical reactions driven by a chemical potential, and often occurring simultaneous with heat and mass transfer.

Classification of Resistances

In the most general case the flow of matter and energy occurs between phases. Total resistance to flow is made up of resistances within each phase, resistances at or near the boundaries between phases, and resistances which are externally imposed upon the process. In many cases, these resistances may result from the interaction of several factors. Where possible, each resistance will be resolved into its fundamental component parts.

An analysis of the resistances which commonly occur in rate processes leads to the conclusion that these fall within two general classifications. One type of resistance lies within a fluid or substance. Its value depends upon the physical properties of the fluid and certain characteristics of the energy possessed by the fluid. We shall refer to these as resistances within the fluid.

A typical example of this type of resistance is that encountered in laminar or streamline flow. Here the resistances opposing flow are shear forces within the fluid. In this series, we shall show how resistance within the fluid may be evaluated for each rate process in the unit operations.

However, resistances within the fluid may be only a part of the total resistance. In the general case there may be resistances by factors external to the fluid. These may be thought of as those due to layers of varying thickness through which energy or mass must pass. We will refer to these as resistances external to the fluid. These layers may be further classified in accordance with the magnitude of the layer thickness and the mechanism by means of which the resistance acts.

Three types of resistances external to the fluid are common. These are:

1. Resistances of small or differential thickness which oppose flow because of interaction between two fluid phases such as gas and liquid. Resistance to flow of matter or energy at or near the interface between a gas and a liquid is such a resistance.
2. Resistances which are of intermediate thickness such as roughness in a pipe, and fouling films or scale in heat exchangers.
3. Resistances which have finite thickness such as those in filter cakes and heat conductors.

In some cases, the resistances within the fluid and those external to the fluid may depend on characteristics of the apparatus. Each type contributes to the total resistance. These resistances may be expressed in dissimilar units which are not always directly additive. Correct combination of these units is necessary to obtain the total resistance.

Consider Thermodynamic Laws

Where the potential which causes flow in one direction is exactly balanced by a potential acting in the opposite direction, the net rate becomes zero. Note that the two potentials need not be the same. This is the basis for the equilibrium-stage or theoretical-plate concept. In this case, the second law of thermodynamics is useful to determine the conditions of equilibrium.

However, this is not the only application of the second law. Often the motivating potential is expressed as the difference between an existing intensive factor such as concentration of a solution and its equilibrium value at some other point, located downstream, in the direction of flow. Here the second law must be employed to determine the equilibrium value and the magnitude of the motivating potential. Of course, whenever energy balances must be made, the first law of thermodynamics must be satisfied.

How to Use the Table

Future articles in this series will be written with reference to the framework shown in the table. By organizing chemical engineering in this fashion, problems in the unit operations can be more easily and logically handled. Where new processes are developed, it will be possible, by reference to the table, to determine their proper place among the unit operations. Hence, a means of handling these operations is readily available.

As these articles appear, it is possible to enlarge upon this table and fill in the resistances and potentials for other operations. By using this scheme, it should be possible to determine the potential and total resistance and, from these, the rate. Once the basic rate equation is set up, the mathematical technique for using this equation to size equipment or to evaluate performance of existing equipment is readily handled.

Because of the increasing use of computers, much emphasis will be placed on definition and formulation of the rate equation. In each case, this will be followed by a brief discussion of the recommended techniques for use of the relations.

Jesse Coates

B. S. Pressburg

JESSE COATES *is head of the chemical engineering department at L. S. U. He is well-known for his contributions to chemical engineering education and research, and to the professional development of engineers.*

He has written extensively on his work in liquid-state thermal conductivities and specific heats, and on simplification of multicomponent distillation and multi-effect evaporator calculations.

He has the Ph. D. degree from the University of Michigan and is a member of four national honorary and five professional societies.

BERNARD S. PRESSBURG *is professor of chemical engineering at L. S. U. where he teaches unit operations and supervises graduate research.*

He is a licensed professional engineer in Louisiana and has a reserve officer's commission in the U. S. Army chemical corps.

Pressburg has the Ph. D. from L. S. U. and holds membership in five professional societies.

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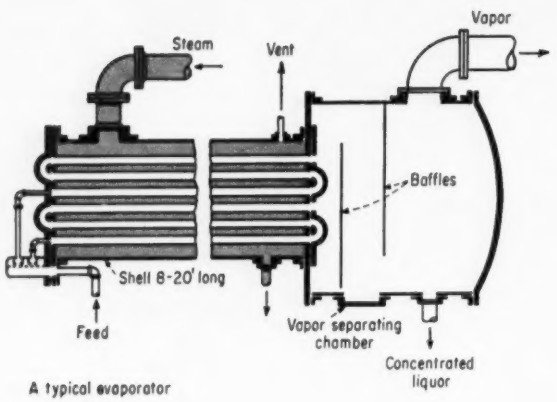
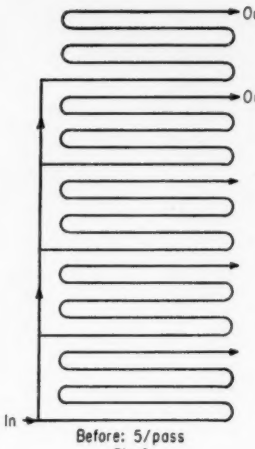
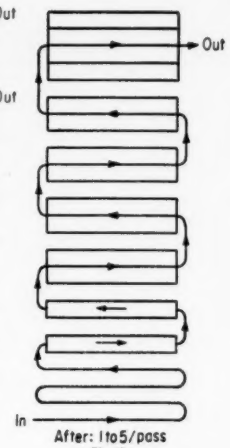


A typical evaporator
Fig. 1



Before: 5/pass
Fig. 2



After: 1 to 5/pass
Fig. 3

Revamp Successful on Old Evaporator

Regrouping of the tubes increased fluid velocity and heat transfer; capacity was doubled and product quality considerably improved.

Chesman A. Lee
Engineer, Evanston, Ill.

Many chemical engineers have never seen a Yaryan evaporator. They were never widely used, but had certain advantages, especially in the handling of foamy liquids. The foam would be quite completely destroyed owing to the high velocity of liquid leaving the coils and striking the baffles. They are still being used* in the evaporation of black liquor in pulp mills and in concentrating glue liquor, gelatin, apple cider and fruit juices. Both single- and multiple-effect designs have been used.

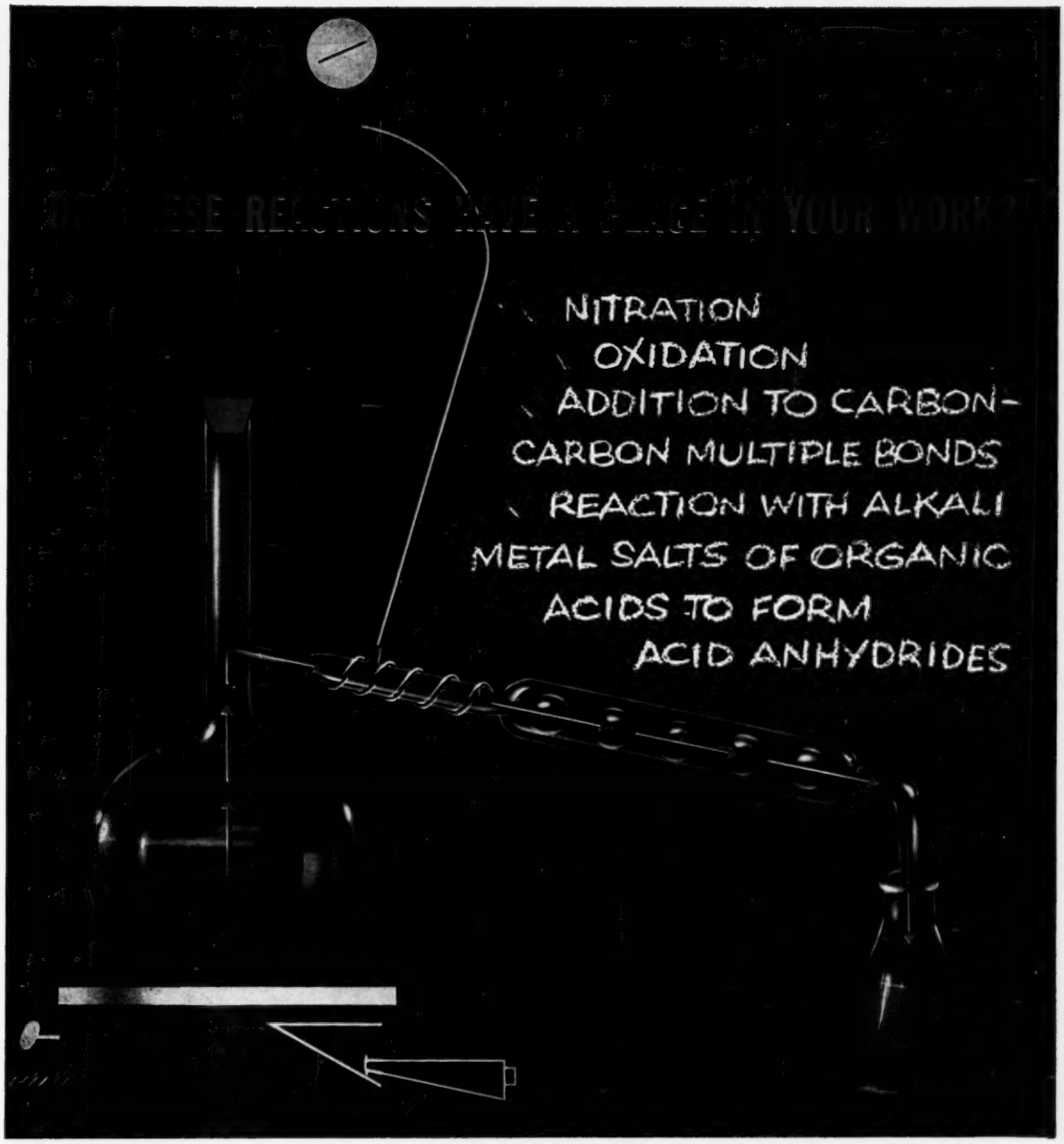
The original design had certain limitations and inherent weaknesses which probably contributed to its limited use. We had a Yaryan on an application where its foam-killing ability was needed. However, the design had within it the seeds of difficulty. At times there was plugging in certain tubes and material would be "cooked," resulting in deterioration of the product. We therefore redesigned the tubing arrangements so as to double the capacity of the evaporator, at the same time that product quality was improved.

The Yaryan evaporator (Fig. 1) consists of a horizontal shell with tube sheets at each end. The product passes through a number of tubes in series, being heated by steam around the tubes, then jets out against baffles within a vapor-separating chamber shown at the righthand end. A typical design might have 25 tubes, 3 in. O.D., arranged in five groups of five tubes each. That is, there would be five tubes in series, with five such series groups fed in parallel. Fig. 2 shows this arrangement.

The unit would be fed through a 2-in. pipe so that there would be a 13:1 reduction in velocity in the first tube of each set. Probably there would be no boiling in these first tubes and it seemed desirable to us to use reduced steam pressure to avoid overheating the slowly moving material at the start. Even so, since it was necessary to use orifices to properly distribute material among the five sets of tubes, the orifices would tend to clog—and then there would be trouble.

When the unit operated prop-

* According to the manufacturer, Sugar & Chemical Machinery Co., Cleveland. Most of the Yaryans were built by this company's predecessor, Kilby Mfg Co.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Critical Pressure	99 atm.
Specific Heat of Liquid	0.36 cal/gm−10 to 20°C
Density of Liquid	1.45 at 20°C
Density of Gas	3.3 gm/liter 21°C, 1 atm.
Vapor Pressure	2 atm. at 35°C

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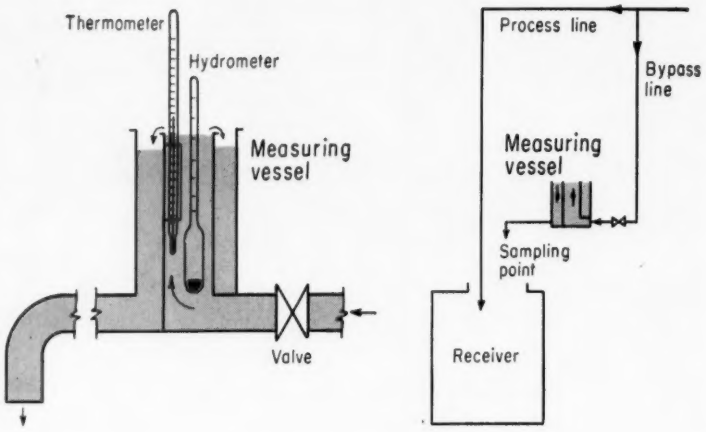
erly, vaporization would occur along the five-tube path and the augmented volume would increase the velocity. As the velocity increased the heat transfer rate would also increase—and vaporization would increase. In other words, the harder it boiled, the harder it boiled! In any event, impingement on the baffles in the vapor separator was really effective and we felt a redesign to overcome the difficulties would be eminently worth while.

In the redesign our object was to regroup the tubes in such a way that velocity would be adequate along the entire path. To accomplish this we designed new head castings to fit the existing tube bundle. All of the feed was put through a single tube for the first four passes, at which point enough vapor had formed to give a good velocity. The next two passes were through two tubes in parallel, and the next four passes through groups of three tubes in parallel. The final pass, leading to the separator, was through five tubes in parallel. This arrangement is shown in Fig. 3. Heat transfer was found to be satisfactory from the start.

When the revamped unit was returned to operation we did receive one complaint. The evaporator was started during the day and ran all night. Next morning the operators complained, "The condenser ran hot all night. That never happened before!" In other words, for the first time the evaporator was transferring heat as it should.

Later on, we raised the steam pressure without further complaint. And when we finally shut down to retube we added a baffle under the steam inlet because we were now condensing enough steam to cause erosion!

The information given here should be enough to guide the revamping of units now in operation, or for building a new one. If you should plan a new installation, you must recall that the unit works without surge capacity on a once-through basis. Therefore, if the resulting liquor requires finishing, on a semibatch basis in a more conventional evaporator, you will need a holding tank between evaporators to provide surge capacity.



Easy Check for Process Flows

C. F. A. Roberts
Orr's Zinc White Ltd., Widnes, Lancs., England

Even in these days of extensive instrumentation there are still many plants where the operators must take samples from a swiftly moving stream of hot, corrosive liquid before they can check its temperature and density.

At the left in the diagram above is a simple piece of equipment which makes it easy to check temperature and density rapidly and safely in a continuously flowing liquid stream. The flow diagram at the right shows how the device is installed in a bypass line. Liquid is diverted from the main stream through a tee, passing down through a valve and then flowing up through the inner cylinder of the measuring vessel. It overflows the lip of the inner cylinder into the annular space formed by the outer vessel, then passes on to the next stage of the process. By mounting the vessel at a suitable distance above the final receiver,

Next Issue: Surplus Searchlight Makes a Solar Furnace

By Paul G. Herold, Winner of the April Contest

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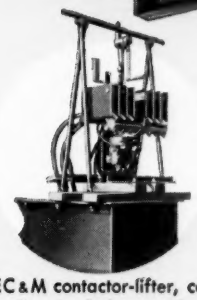
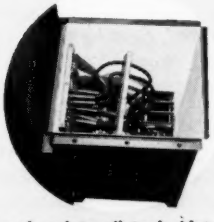
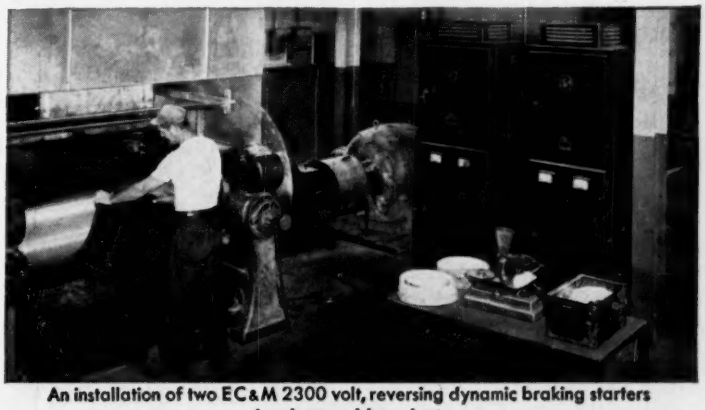


With EC&M contactor-lifter, contactor is easily raised above oil level for easy inspection without disconnecting any bolts or leads



Down-view into oil tank. Note compactness of contactor and transformer assembly. All leads are anti-syphon



An installation of two EC&M 2300 volt, reversing dynamic braking starters in a large rubber plant

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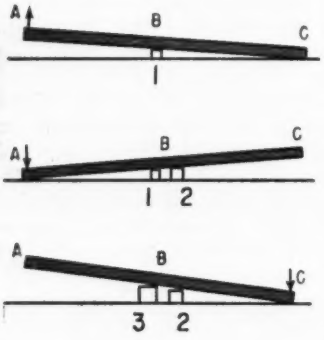
samples can readily be taken for further examination.

Construction of the measuring vessel is self-evident. The dimensions are not critical, but a cylinder height of 8 in., and diameters of 2 and 4 in. for the inner and outer cylinders, have worked satisfactorily in practice.

The temperature of the flowing liquor can be checked at any time. However, to find the density, it is necessary to close the valve and wait a few seconds while the hydrometer settles down. The valve is kept open, of course, except when taking a density reading.

The heights of both cylinders are the same to avoid errors due to parallax. And the indicated area of annulus is great enough to take the necessary small flow without flooding.

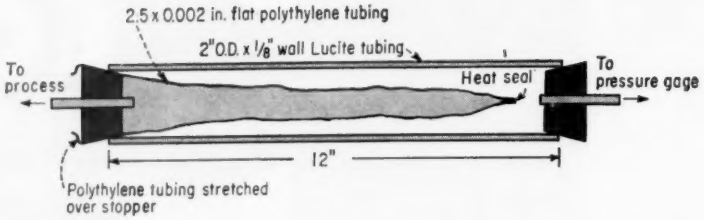


"Walk" Your Pipe Up Without a Hoist

W. G. Hudson
Union Carbide Olefines Co.
South Charleston, W. Va.

With adequate cribbing or shoring, the method shown here is both simple and safe for raising pipe, shafts or long beams when no hoist is available.

In the top sketch, raise end *A* with a jack or lever and put Block 1 just to the left of the balance point. Then force *A* down as in the second sketch and put Block 2, slightly higher than 1, to the right of 1. Force end *C* down and replace 1 with a still higher Block 3. Thus the beam or pipe can be "walked" up to any desired height.



Isolating Seal for Gages

Herbert P. Cantelow
Lawrence Radiation Laboratory, University of California
Berkeley, Calif.

Protecting delicate pressure gages from corrosion by process streams can be difficult in some cases. The problem can be still more difficult if the process stream is radioactive, as it was in the instance described here.

Our problem was to measure and control the slight negative pressure—about 1 in. w.g.—maintained in the gloved boxes used as enclosures for radioactive work. The instrument available was actuated by a brass bellows and had a full-scale range of 5 in. w.g. and a corresponding bellows displacement of 50 cc.

We were unable to use a purge system because of a requirement to keep all leakage into the system to an absolute minimum. The atmosphere in the box would contain hazardous radioactive contaminants, in addition to various acidic vapors, so reliability and accuracy were of primary concern.

The isolating seal illustrated above solved this problem with complete success. A long, thin polyethylene bag used as the isolating membrane is the heart of the device. The design has the important feature of allowing a large displacement of gas without any measureable effect on the transmittance of pressure. It was the only one of several designs tried which was completely satisfactory in this respect.

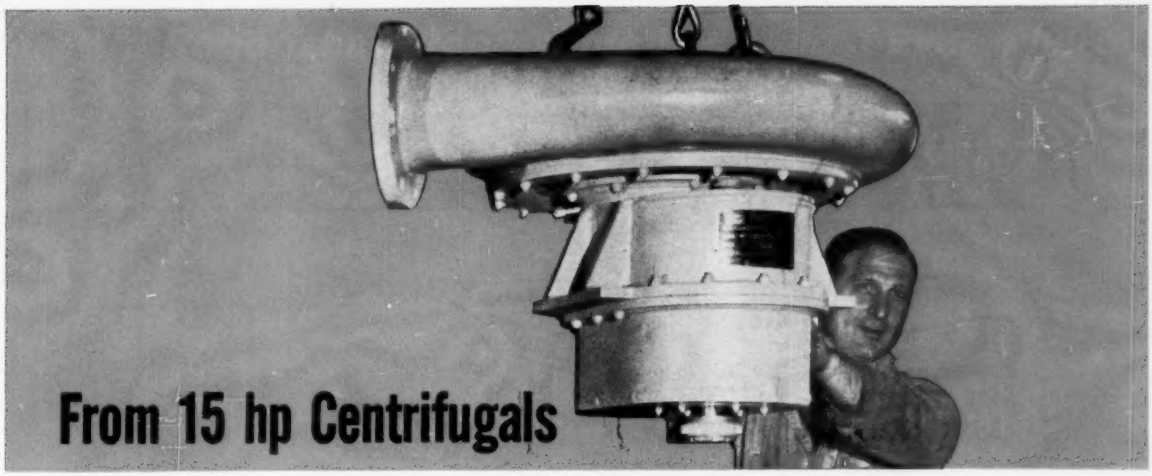
The polyethylene material used was a length of thin-walled tubing of the type normally used in making bags. The tubing was 2½ in. wide when flat (width, not diameter) and 0.002 in. thick. Such tubing can be obtained from the plastic-bag fabricators.

One end of the tubing was heat-sealed to form a long, thin bag. We then drew the open end over a No. 10 rubber stopper and inserted the assembly into one end of a 12-in. length of 2-in. O.D. Lucite tubing. Another stopper at the other end, plus tubing nipples through both stoppers, completed the device.

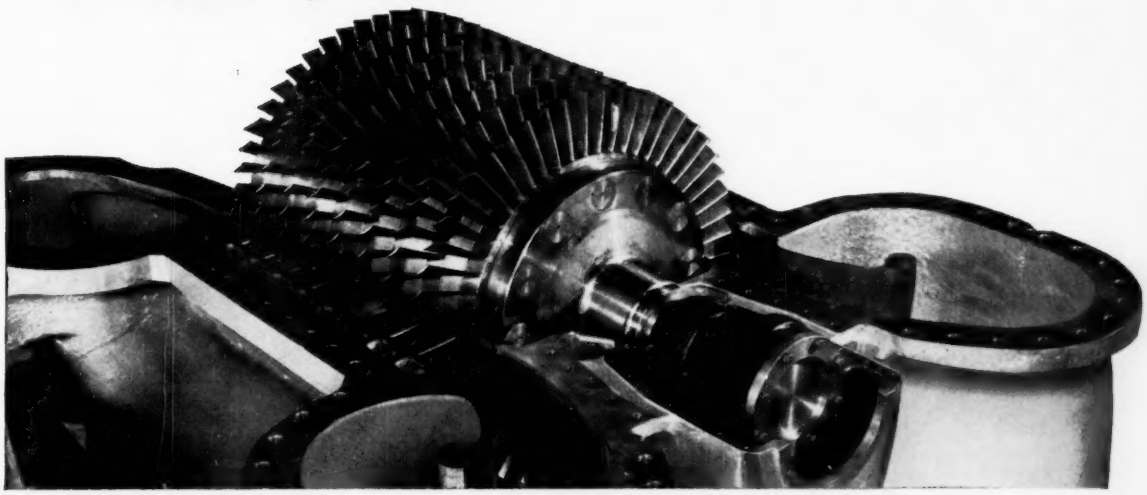
Owing to the use of a transparent Lucite outer chamber it is easy to inspect the interior polyethylene membrane to make sure it is operating properly—that is, neither fully distended nor completely collapsed, as might occur if a leak should develop.

One feature of this seal is particularly useful when the process gas stream is radioactively contaminated. Since the polyethylene membrane has been stretched over the rubber stopper, both stopper and membrane can be removed as a unit. This allows the pressure gage to be disconnected from the system without fear of contamination, since no opening need be made in the "hot" side of the system. The cost of discarding a contaminated polyethylene membrane and stopper is negligible and the instrument can be quickly put in shape for further use merely by inserting a new membrane and stopper into the Lucite tube.

Work done under the auspices of the U. S. Atomic Energy Commission.



to 15,000 hp Axials . . .



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PRACTICE . . .

YOU & YOUR JOB

EDITED BY R. F. FREMED

Your Rights Under Collective Bargaining

You've been selected as a target. In the months ahead you'll be subjected to the stepped-up organizing efforts of engineering unions, Walter Reuther and even Jimmy Hoffa.

One in five of you may actually welcome the organizers. Recent surveys show that a sizable minority of professional employees regard some sort of collective action favorably.

Whether you are for or against unionization, you'll be better prepared for the coming battle after you read this article.

Robley D. Stevens, Management Consultant, Washington, D. C.

In substance, the Taft-Hartley Act states that anyone has a right to self-organization; to form, join or assist a labor union; to take part in group activities for collective bargaining purposes with respect to wages, hours and working conditions.

With one exception, moreover, you have a right to refrain from or refuse to engage in any or all of these activities. The National Labor Relations Board has been given the right to decide what unit is appropriate, proper or fitting for collective bargaining purposes. If NLRB certifies a professional union as the appropriate unit for collective bargaining with your employer, then you would no longer have much choice.

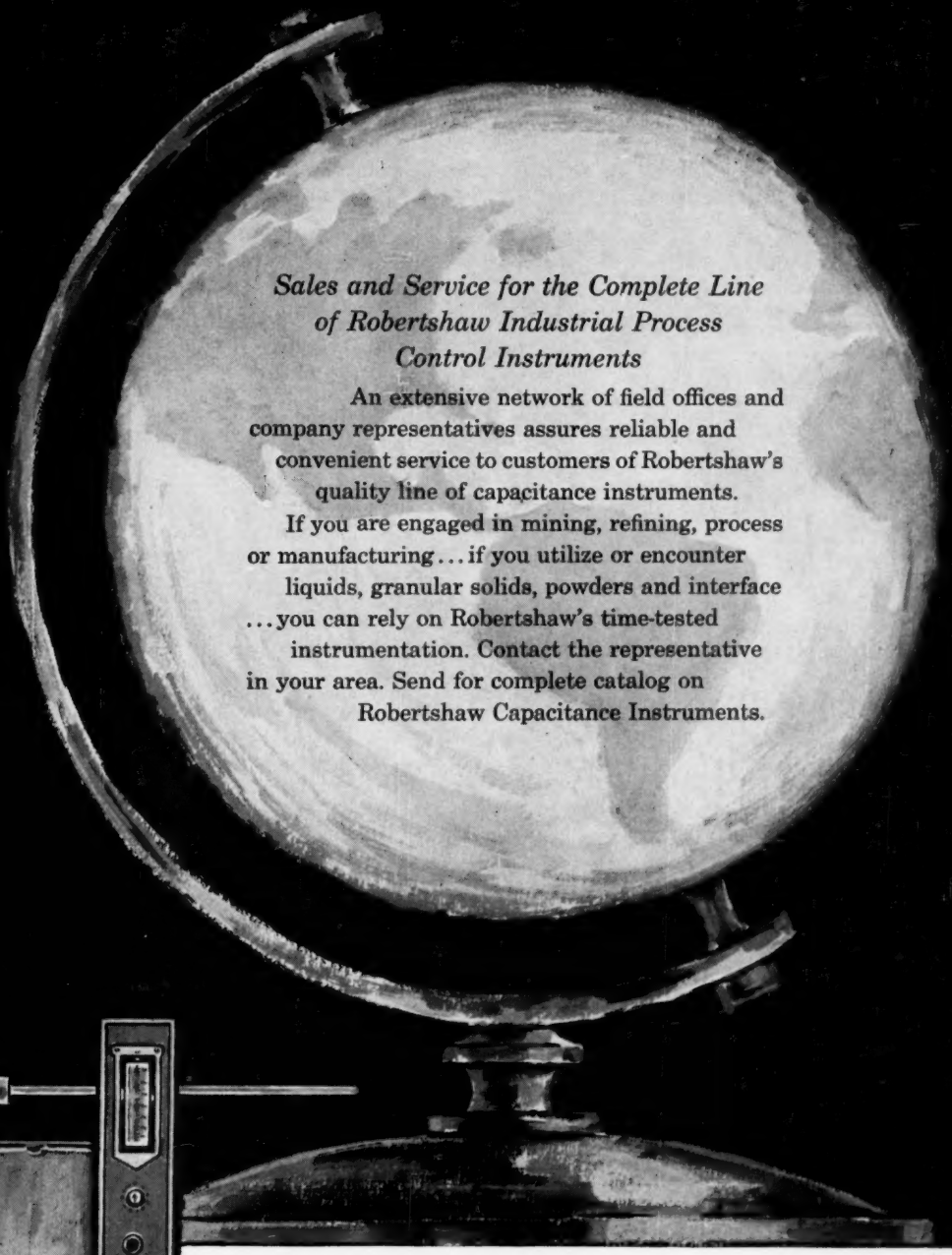
Just to cite one example, in Wichita, Kan., the Boeing Airplane Co. bargains collectively with 1,127 professional employees through the Wichita Engineering Ass . Yet, the official union publication claims only 367 union members. (Figures were as of June 1958.)

Must Vote on Mixed Units

"Hold on," you may say. "As a chemical engineer, don't I have the right to decide if I should be included in a group of nonprofessional employees?"

Here's what Taft-Hartley has

There's a Robertshaw Representative Almost Everywhere



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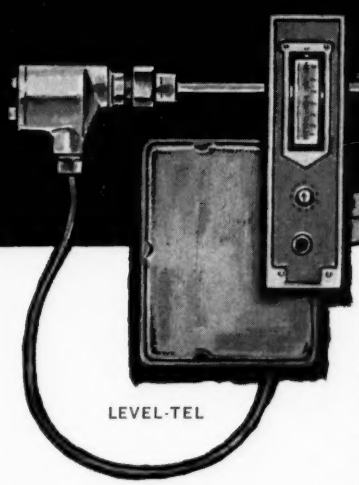

LEVEL-TEL

LEVEL-TEL. A continuous level system which detects, measures and visually indicates changes in media level. **LEVEL-TEK.** An on-off device which operates local or remote warning devices or motor driven valves and pumps when a predetermined level is attained. **LEVEL-SET.** An instrument which converts changes in level to proportional changes in air pressure for maintaining a constant head in vessels where pneumatic feed control systems are employed. **LEVEL-LOG.** A versatile and extremely accurate RF null balance capacitance system for level measurement, recording and control. **Robertshaw-Fulton Controls Company, Aeronautical & Instrument Division, Santa Ana Freeway at Euclid Avenue, Anaheim, California.**

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to say on this question: "Representatives, designated or selected for collective bargaining purposes by the *majority* of employees in a unit appropriate, shall be the *exclusive* representative of all employees in order to bargain over wages, hours and working conditions."

Now it's possible that NLRB may group you in a bargaining unit that includes both professional and nonprofessional employees. However, the law restricts NLRB in this way: "The Board shall not decide that any unit is appropriate if such includes a majority of professional employees, unless a majority of such professional employees vote for inclusion in such unit."

A recent U. S. Supreme Court decision on this very point (*You & Your Job will report on this in a forthcoming issue.*) makes it quite certain that the Taft-Hartley law does not *allow* NLRB to include nonprofessionals with professionals in the same unit, *unless* the professionals themselves vote by secret ballot to include the nonprofessionals.

The Supreme Court ruling, that there shall be "no mixing" without election, forces NLRB to make a clear-cut separation between professionals and nonprofessionals, in order to avoid violating the law.

Who then is a professional engineer?

You Are a Professional

According to Taft-Hartley, you are a professional engineer because you are engaged in work predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical or physical.

Also, your work involves the consistent exercise of discretion and judgment in its performance; your work is of such a character that the output produced or the result accomplished cannot be standardized in relation to a given time period; your work requires knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual or physical processes.

Until Taft-Hartley came along you may have questioned the professional standing of chemical engineers. Now there can be no doubt. Just as Army officers are automatically classified as "gentlemen" by Act of Congress, so chemical engineers are "professional employees" by act of Congress.

You Can't Go by Title

However, even this is not certain. In deciding whether employees are "professional" within the Taft-Hartley definition, NLRB looks at the specific work you perform, rather than your job title.

NLRB found in one case that employees engaged in routine chemical testing were technical rather than professional. But in the same department NLRB found another group of chemical testers who were professional employees because practically all of them were college graduates with degrees in chemistry or chemical engineering and they performed work which involved continual use of their scientific knowledge.

Similarly, NLRB found a chemist who was not a college graduate to be professional because he had 18 years of laboratory experience and exercised independent judgment. But another chemist who had a college degree was not a professional employee, since he merely assisted in the testing of products under the close supervision of a nonprofessional laboratory head.

Mistakes Will Be Made

The average manager of chemical engineers, you must remember, has had little experience in bargaining collectively with his employees. And as a chemical engineer you have had even less experience in dealing with collective bargaining. Here are some important things to keep in mind should union pressure be exerted upon you.

First, you should understand that under the Taft-Hartley Law the term "to bargain collectively" is defined as the performance of the mutual obligation of the employer and the representative of the employees:

1. To meet at reasonable times.
2. To confer in good faith with respect to wages, hours, and other terms of employment, or the negotiation of an agreement, or any question arising thereunder.
3. To execute a written agreement incorporating any agreement reached, if requested by either party. However, such obligation does not compel either party to agree to a proposal or require the making of a concession.

Next, you should understand that neither your employer nor a labor union may interfere with, restrain or coerce you in the exercise of your collective bargaining rights. Otherwise charges of unfair labor charges may be made.

This does not mean that your employer or a union cannot talk. Congress says this on free speech: "Expressing of any views, arguments or opinions, or the dissemination, thereof, whether in written, printed, graphic or visual form shall not constitute or be evidence of an unfair labor practice act, if such expression contains no reprisal or force or promise of benefit."

Know Your Rights

You can see that there is nothing in the Taft-Hartley Act that forces you as a chemical engineer to meet the demands of a union or to give in to it during the bargaining process.

So, if you become the target of union organizers in the months ahead, watch out for possible violations of the protection afforded you by law.

The Taft-Hartley Act makes it unlawful for a labor union to engage in a strike or boycott the object of which is to force you to join that union; or to force or require any employer or employee to recognize or bargain with a labor organization that has not been certified as the representative of his employees.

Collective bargaining is not a simple subject. It requires knowledge, training and experience. But there is no reason why you cannot be an expert on what your rights are as a professional chemical engineer.

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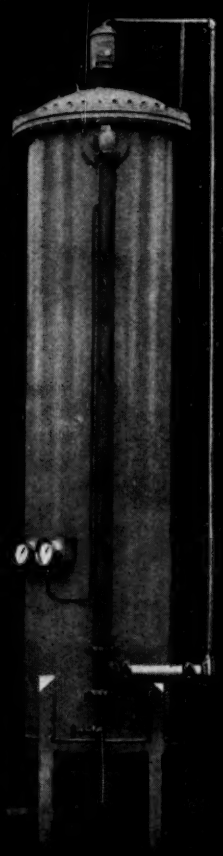

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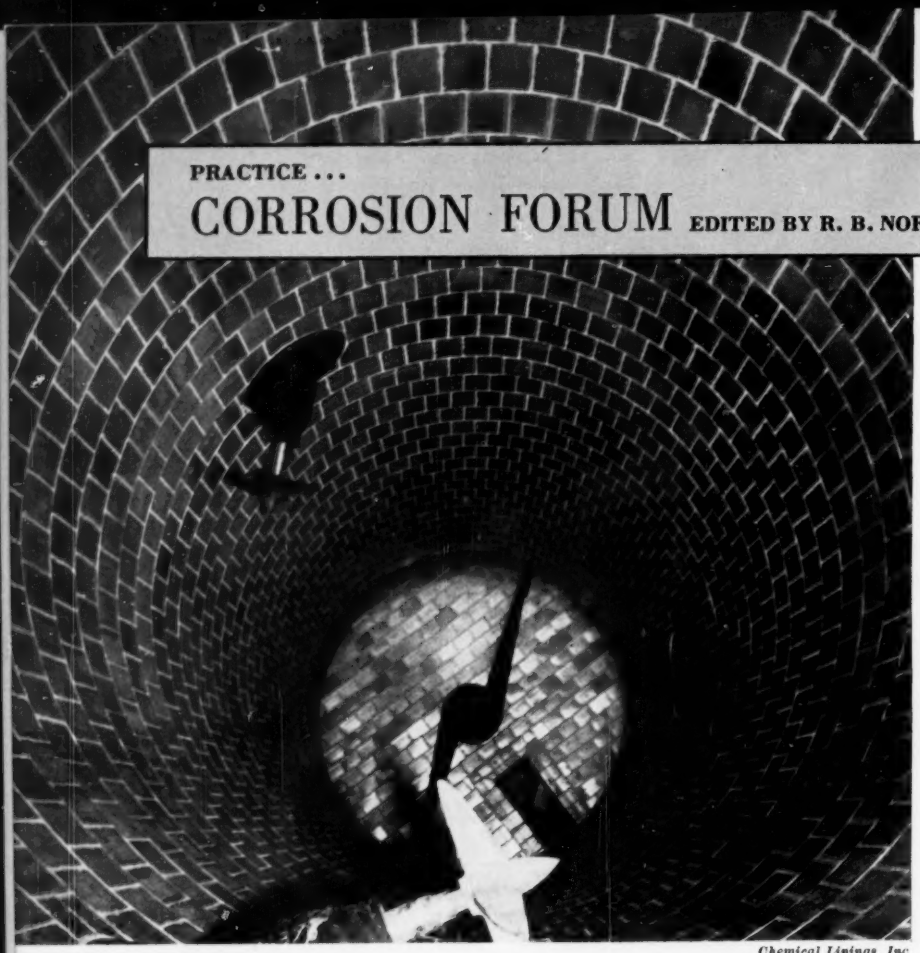

Chemical Linings, Inc.

Prestressed Brick: Cure for Lining Woes

Now brick lining can take high temperatures and pressures without spalling, cracking or separating. Key to technique now becoming popular in U. S.: prestressed brick.

John A. King, Assistant Editor

A novel design technique, now becoming popular in this country, is giving a big boost to an old, but often overlooked, fabrication method: brick lining of process vessels.

Involving use of prestressed brick and precise engineering calculations, the technique produces a lining much superior to standard brick or clad metal linings.

For instance, prestressed brick lining, it is claimed:

- Withstands temperatures to 2,000 F., pressures over 1,000 psig., and wide temperature and pressure fluctuations. Usual brick can't take such severe conditions without spalling, cracking or separating from the shell.
- Costs less than many alloy claddings or shells; competitive with stainless clad.
- Outlasts alloy claddings, offers as much as 20-30 years of service.
- Requires little maintenance; only an annual inspection of brickwork.
- Reduces, often eliminates, external insulation.

Chemical industry in Germany was first to take advantage of these benefits. Farbwerke Hoechst, A. G., Frankfurt, de-

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veloped the special mortars and design calculations which make the technique possible. These mortars permanently expand, when thermally cured, and place the brick lattice under compressive stress (brick is strong in compression, weak in tension). It prevents cleavages in the brick lining and separation from the shell.

Pennsalt Chemical Corp., Natrona, Pa., has announced plans for production of these mortars here, under license from Farbwerke Hoechst. The foothold that prestressing is gaining here in the U. S. spurred Pennsalt to plan production of the mortars. Pennsalt is working closely with U. S. construction companies who build brick-lined vessels; has discussed design details with a number of engineering outfits; looks to inclusion of the technique in ASME codes (Germany has included it in their DIN code).

A number of companies—including Frontier Chemical Co., Toms River Chemical Co. and Standard of California—are testing the technique's virtues; they have lined vessels using German-made mortar.

► **Why It Works** — Essentially, the engineering calculations for a prestressed brick lining involve balancing various stress and elongation equations. Mortar, brickwork and steel shell thicknesses must all be carefully specified—a somewhat tedious procedure.

But to understand just how the technique works, you have to realize what happens to the usual brick lining under a rising temperature. When the vessel has reached operating temperature, chances are the steel shell has expanded much more than the brick. A gap develops between the brick and the shell, the brick is placed in tension, and the lining starts to crack and spall. At high temperatures this condition often eliminates brick as a lining material.

But in prestressing the vessel is given a heat (and pressure) treatment which deliberately expands the steel a definite amount. At the same time the special mortar "permanently elongates." This swelling fills the gap between the lining and the shell, bonding steel to brick in the expanded condition. The vessel temperature is then slowly lowered, the steel shrinks around the lining, and this together with the expanded mortar, places the inner fibers of each brick in compression. No dangerous stresses develop when the vessel is brought up to operating temperature and pressure.

► **In Hardware**—But prestressed brick has gone past the theory stage in this country.

Frontier Chemical recently replaced a 56-ft. high, 7-ft. dia. Inconel tower with a prestressed-brick-lined carbon-steel vessel. The tower was used for chlorination at 1,250 F., 40 psi.

Laboratory studies showed that the Inconel tower wouldn't last more than two years when exposed to the severe operating conditions. And ordinary brick lining would never withstand the pressure and temperature. But the prestressed-brick liner shows no sign of cracking, spalling or separation from the shell after three years of service; it will probably last at least ten years.

A breakdown of installed costs for Inconel and prestressed brick towers points up advantages and limitations of the lining (see Table I).

For the prestressed-brick, steel tower, materials costs were about half those for the Inconel

Labor Is Big Item in Lining Costs

Table I*

	Prestressed-Brick Construction	Inconel Construction
Cost of vessel	$19,046	$73,500
Cost of bricks and mortar	18,550	.....
Total materials costs	37,596	73,500
Cost of bricklaying	19,700	
Cost of erection	6,000	7,500
Total cost of construction	25,700	7,500
External insulation cost	.....	14,300
Total installed costs	$63,296	$95,300

* 56 by 7-ft. vessel, 1,250F., 40 psig.

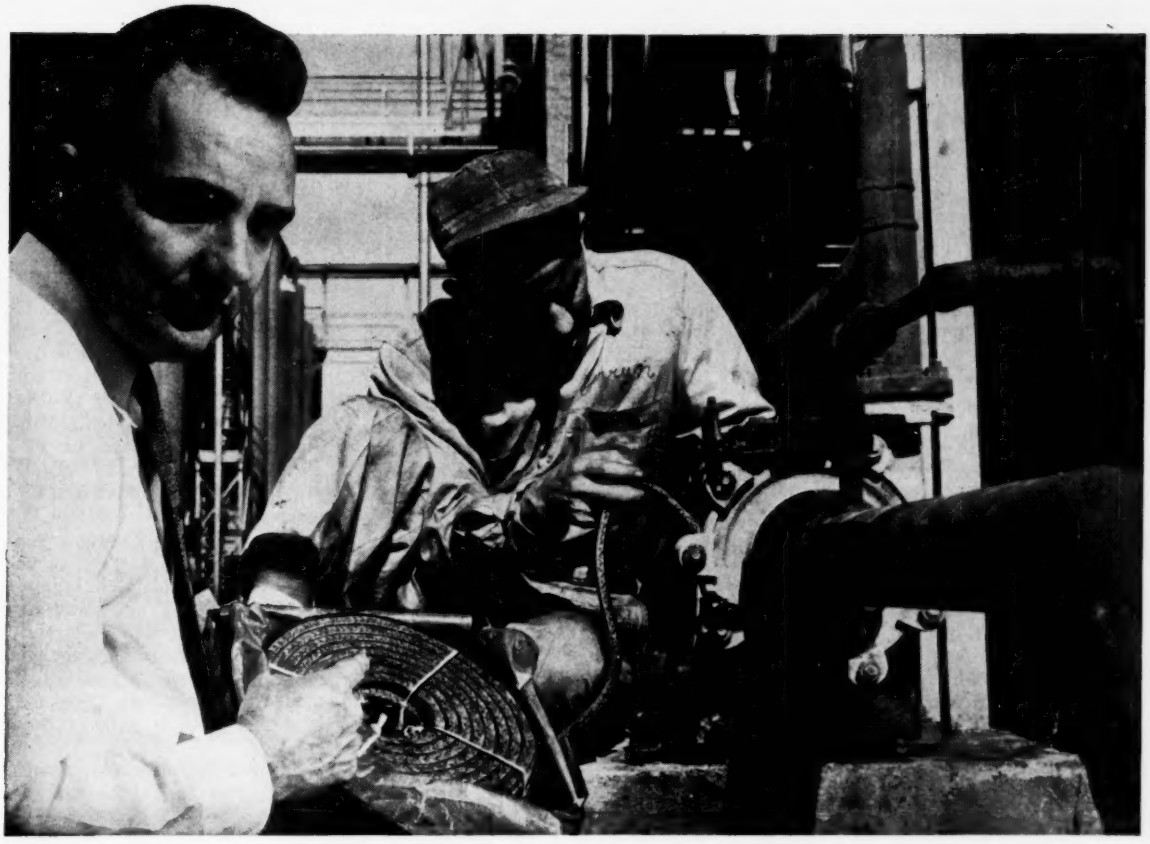
Prestressed Brick Construction Cuts Costs

Table II*

Construction	Material	Estimated Fabricated Cost, $	Savings If You Use Prestressed Brick, $
Prestressed-brick-lined carbon steel	2⅜-in A-212 carbon steel (stress-relieved & X-rayed)	102,000	
Stainless-clad 20%	3-in. A-302 stainless-clad plate	112,000	10,000
Solid stainless	3-in. 304 stainless plate	135,000	33,000
Hastelloy-clad carbon steel	3-in. Hastelloy cladding	185,000	83,000
Solid Hastelloy	2⅞-in. Hastelloy C	385,000	283,000

* 40 by 10-ft. vessel 850F., 650 psig.

SOLVENT PACKINGS



"We tested one packing after another... but only 'U.S.' could stand up,"

Says CHEMICAL PLANT SUPERINTENDENT

When a leading mid-western chemical company put their new plant into operation in 1955, they faced a problem with pump packings: To find a packing resistant to a combination of solvents, caustic and high temperature—with a minimum of shaft wear.

"We tested one packing after another on our caustic pumps," says the plant superintendent, "and found that U. S. Solvent Packing outlasted any other packing tested *by as much as 10 to 1.*"

Result: No more morale-breaking "clean-up" sessions, production is increased, personal injuries due to leaks have been reduced 75%, and there's no need for rescheduling due to breakdowns.

A "U. S." technician, of course, worked with engineers of the chemical company to develop the right packing for this particular requirement. That's part of the "U. S." service, when needed.

• • •

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tower. And external insulation was eliminated completely. But labor and field construction costs for brick lining alone was more than double the total field construction cost for the Inconel.

Here in the U. S., where labor costs are relatively high, this is an important factor. For complex designs, demanding complicated and extensive brick laying, high labor costs may exceed savings on materials. For example, prestressed-brick-lined, tray, scrubbing towers would create a problem here in the U. S. where labor is so costly. But for highly corrosive operating conditions, where more exotic claddings and materials of construction are required, high labor costs are more than justified.

Table II shows estimated savings resulting from the use of prestressed-brick-lining instead of Hastelloy or stainless steel for a hypothetical vessel. It's a typical, 40-ft.-high, 10-ft.-dia. vessel, equipped with 12 nozzles ranging from 3 to 12 in. and 2:1 eliptical heads. Operating conditions are 850 F. and 650 psi.

▶ **How to Install**—The actual installation of the brick is not very complicated.

First an impervious coating of resin is painted inside the shell, to prevent contact of corrosive fluids that might penetrate the brick lining.

Then bricklayers lay the brick lining in the usual manner with the special mortar. Usually several courses (layers) of brick are required. To decrease possibility of fluids penetrating the brickwork, courses are staggered, when possible.

Thickness of the bricks, number of courses, type of precoat, and mortar type and thickness all depend on the operating temperature and pressure.

Once the brick lining has been laid it must set for 6 days to 6 weeks, depending on the mortar thickness, to permit the mortar to dry. Then comes the curing or prestressing step.

To cure the lining, the vessel is gradually filled with fluid that is hotter than the maximum operating temperature, then very gradually a pressure is applied in the vessel greater than the operating pressure. The prestressing mortar swells but remains bonded to the shell and brickwork.

When the swelling is completed for the curing conditions specified, the vessel is gradually cooled by discharging the hot fluid. Pressure is also released. The shell contracts placing the elongated brick liner under compressive stress. The vessel is then ready to go on stream.

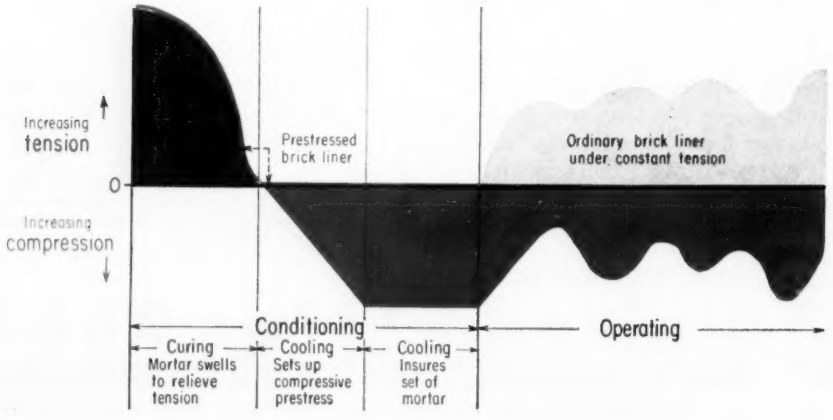
Operating pressure and temperature result in some relief of the brick liner's compressive stress, but never results in total relief to a high tension. Cracking of the brick liner is unlikely; and because the mortar tightly bonds the bricks to the shell, the liner cannot separate from the shell. The chart graphically shows how prestressing technique works from curing to operation.

▶ **Operating Difficulties** — From an operational viewpoint there are some difficulties in working with prestressed-brick-lined vessels. They are hard to inspect and they're not very versatile. It is a difficult problem to add new fittings to a vessel once the liner has been cured without endangering the integrity of the entire liner. So, before using this technique, consider the permanency and required versatility of the vessel and install all the fittings needed.

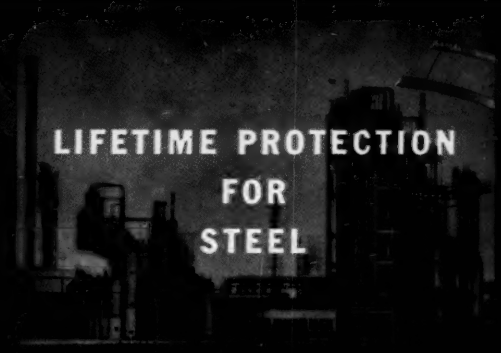
▶ **Design Hints** — There are a number of design factors to be considered with this technique to minimize costs. First, avoid restraints to the shell. For example, avoid flanged or dished heads; rather use 2:1 elliptical heads where possible. Support the vessel with a skirt rather than legs.

Minimize the brick-liner's complexity. The fewer the discontinuities, the better the design. Avoid trays, internal lugs, supports, beams or brackets. But if they are a must, reinforce the shell locally to minimize stresses and eliminate hot spots.

Prestressed Brick Liner—
Always Under Favorable Operating Stresses **Fig. 1**



The new corrosion film everyone is talking about!



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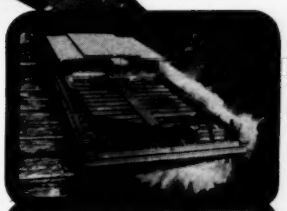
Here is an authoritative film that answers many questions on the theory of corrosion and demonstrates methods by which it is controlled. Presented in color and sound, it ranges from the formation of anodes and cathodes through the use of galvanizing, inhibitors, metallizing, cathodic protection, alloys and protective coatings. You will see how many corrosion problems in industries such as yours are being solved by Dimetcote, a one-coat zinc silicate protective coating. This film will be well worth 19 minutes of your time. To arrange a showing for you and your associates, or to learn when it will be shown in your area, contact any of the Amercoat offices listed below.



Typical audience reactions:

Bishop, Tex.—"Planning fair-sized test after seeing this film."

Louisville, Ky.—"Answers many questions. Second showing arranged."

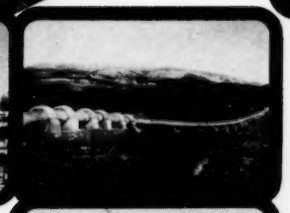
Cincinnati, Ohio—"Key personnel evidenced considerable interest."

Netherlands Antilles—"Both shows led to 45-minute discussions."

Fairport, Ohio—"Very interesting. Will try methods shown."

Las Piedras, Venezuela—"Putting ideas to work in near future."

Bartlesville, Okla.—"Viewed by 42 key men from five divisions."



Answers these and other questions:

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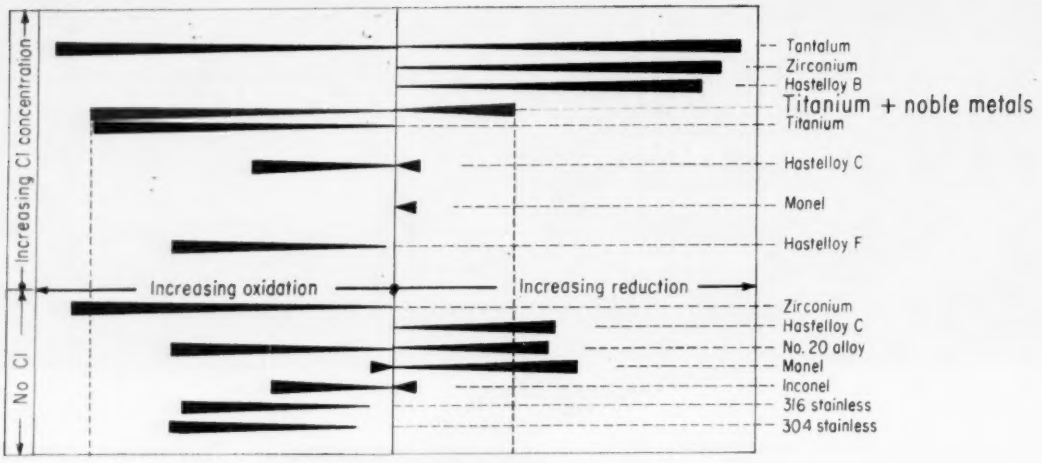


New Alloy More Resistant Than Pure Ti

Titanium with 0.1% of a noble metal is much more of a "wonder" metal for corrosive service than pure titanium.

Amid all the drum beating for titanium a few years ago, a simple fact was often overlooked or glossed over: Pure titanium is far from the "wonder" metal for corrosive service.

It is excellent in most oxidizing environments, but no good in reducing media such as dilute hydrochloric or sulfuric acids. This situation has changed with the recent introduction of Union Carbide Metals' new titanium alloy which greatly extends the operating range for titanium (*see chart above*).

▶**Big Selling Point**—The UCM metallurgists have found that adding 0.1% of a noble metal makes titanium resistant to reducing acids, while not affecting mechanical properties or resistance to oxidizers. So the "noble-metal Ti-alloy" has one big selling point: it can be used under process conditions which may go from oxidizing to reducing.

UCM has settled on palladium as the noble metal, although platinum, gold, rhenium, rhodium, etc. also work.* Palladium costs about $19/troy oz., adds about 28¢/lb. to the price of titanium mill products.

Milton Stern, developer of the new alloy at UCM, gives an electrochemical theory for the noble metal's role: it creates a galvanic couple and serves as a site with a low hydrogen overvoltage.

▶**Low Corrosion Rates** — How well palladium does its job shows up in laboratory corrosion tests.

Unalloyed titanium has a corrosion rate of about 460 mils/yr. in boiling 1% sulfuric acid, while Ti-0.1 Pd has a rate of about 2 mils/yr. (a rate of over 50 mils/yr. is generally considered excessive).

In boiling 3% HCl, titanium corrodes at 242 mills/yr.; Ti-0.1 Pd has a rate of about 2 mils/yr.

However, the new alloy will not handle all acid concentrations: it corrodes at 100 mils/yr. in 10% boiling HCl; at 50 mils/yr. in 10% boiling H_2SO_4.

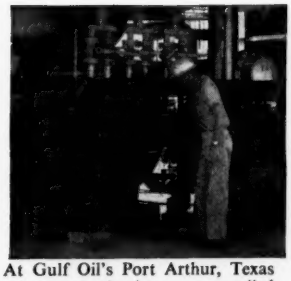
The alloy is yet to be tested under plant conditions. Columbia-Southern Chemical Corp. plans to include it in their "second round" of chemical plant exposure tests. The first round results on titanium and zirconium were reported by P. J. Gegner and W. L. Wilson at the March 16-20, 1959 NACE meeting in Chicago.

▶**High Costs**—There's no doubt the UCM development greatly extends usefulness of titanium as a corrosion-resistant material. But Ti's big problem—high price—still remains. For standard gage sheet, current prices/lb. look something like this: 90¢ for stainless 316; $3 for Hastelloy alloy C, $7.50-9 for titanium; $16-18 for Zr and $60 for tantalum. Fabricated equipment comparative costs based on a 100 sq. ft. fixed tubesheet heat exchanger are: 1.0 for 316; 2.2 for Hastelloy alloy C; 2.8 for titanium; 4.2-5.6 for zirconium.

* Union Carbide Metals plans to offer licenses to produce the alloy to titanium mill products producers who in turn sell to fabricators. UCM will make Ti-sponge, and Ti-master alloys for addition to the sponge.

For tested generator performance . . .

Come to Kemp



At Gulf Oil's Port Arthur, Texas refinery, purging inerts are supplied by Kemp Generator and Kemp Dryer working as a team. The units produce 30,000 SCFH for a bountiful and easily controlled supply at low cost.

Tested . . . and proved! Factory tested with rigid component checks, field tested by Kemp engineers at installation, and time tested by years of actual use. Proved that Kemp Inert Gas Generators are built to last, built to produce, built to be accurate.

At the heart of every Kemp Generator is the Kemp Industrial Carburetor, uncomplicated in concept, yet outstanding in performance. It provides sensitive and accurate control of inert analysis. A quick setting of the calibrated dial insures delivery of an unvarying mixture, regardless of line demands.

And Kemp design—rugged, simple, and sturdy—means that maintenance and attendance requirements are kept to a bare minimum. Kemp Inert Gas Generators stand up under the toughest conditions, yet produce with complete dependability.

Your Kemp Representative is listed in *Chemical Engineering Catalog*. Call him for full information when you plan a new installation or wish to update an old one. Or write for Bulletin D-102. THE C. M. KEMP MFG. CO., 405 E. Oliver St., Baltimore 2, Md.

Convection Dryers

Atmos Generators

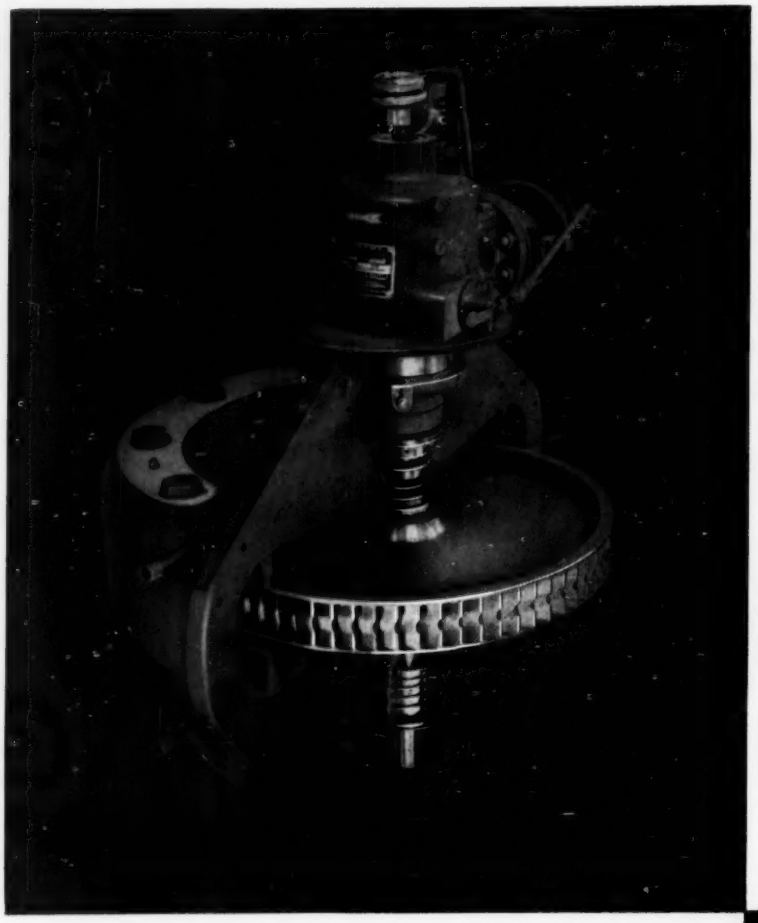
Nitrogen Generators

Orlad Dryers

Here's a vertical turbine with

TERRY SOLID WHEEL

and all its advantages



When it comes to judging a turbine's ability to deliver in vertical service, ratings tell only half the story. It's the Terry construction refinements that give you assurance of long-range operational economy: Thrust bearing designed to absorb external pump thrusts ... carbon ring glands specially made for vertical operation ... casings and bearing housings split vertically for easy accessibility.

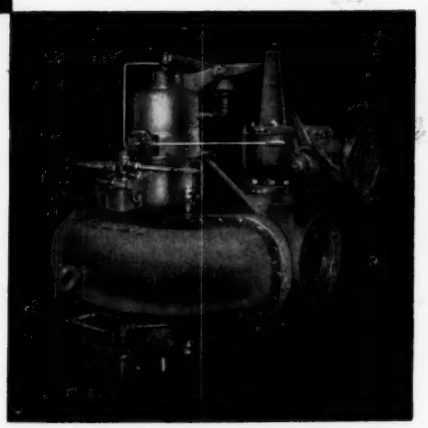
But most important, the Terry vertical turbine has an *almost* indestructible rotor. A single forging of special composition steel, it has no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

If your application demands a vertical turbine, specify Terry solid wheel. Available in capacities from 5 to 300 horsepower. And remember, the extra durability built into these vertical turbines is typical of every turbine in the complete Terry line.

For further information, send for a copy of bulletin S-137.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

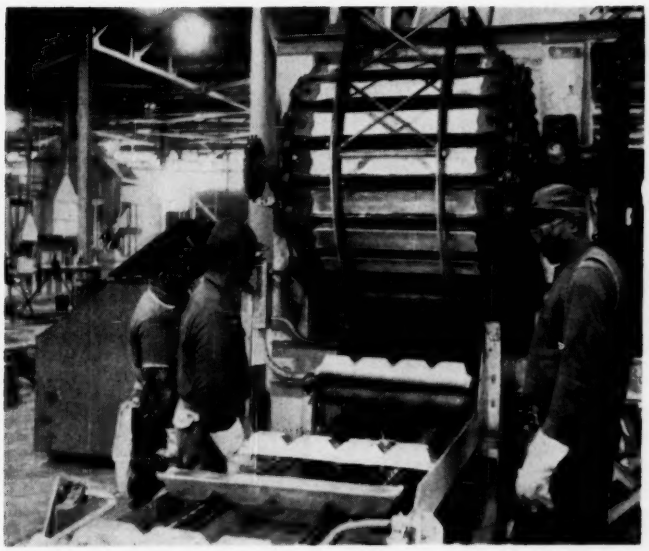


TT-1210

FIRMS IN THE NEWS

R. A. LABINE

NEW FACILITIES



New Smelter Makes Aluminum Alloys From Scrap

American Smelting & Refining is now in production of aluminum alloys at its new 72-million-lb./yr. secondary smelter in Alton, Ill. Incoming aluminum scrap is remelted and mixed with alloying metals; finished ingots roll off one of three casting lines like the one shown above.

Arizona Chemical Co. has completed plans for construction of a 40,000-ton/yr. tall oil refinery in Springhill, La., that will be in production by summer of 1960. Company is a jointly owned subsidiary of American Cyanamid and International Paper.

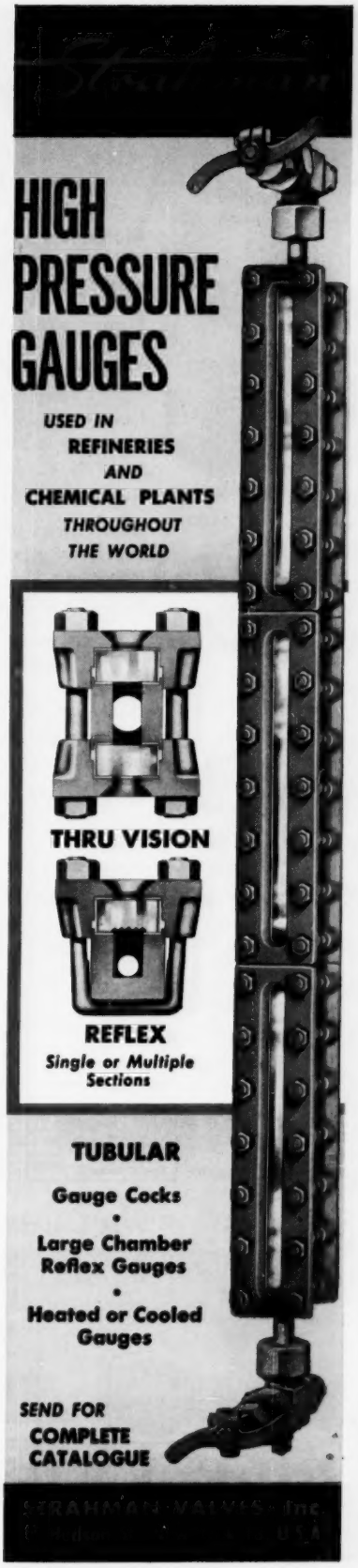
Spencer Chemical is erecting a "substantial" addition to its high-pressure polyethylene plant at Orange, Tex. Addition is scheduled to be completed by the summer of 1960.

North Star Chemicals has construction under way on a 240-ton/day sulfuric acid plant at Pine Bend, Minn.; slated completion date is last quarter of 1959. Titlestad Corp. of New York is supplying the engineering.

National Cylinder Gas, division of Chemetron Corp., has placed its $1.75-million gas plant on stream at Los Angeles, Calif. Unit can produce more than 35 tons/day of liquid oxygen, nitrogen and argon.

Bell Laboratories announces that it plans to erect a $20-million laboratory at Holmdel, N. J., on a 430-acre site. Occupancy of the first portion of the building is expected in late 1961.

Fibreboard Paper Products Corp. is building a new multimillion dollar paperboard mill at its San Joaquin plant, 45 mi. east of San Francisco. Third paperboard machine will initially add 72,000 tons



Why different ALUM applications require different feeders

LOSS-IN-WEIGHT

Alum can be fed by weight . . . by volume . . . either wet or dry! No single feeder suits every application . . . it pays to ask B-I-F why!

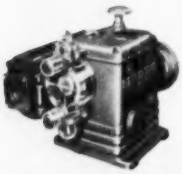
GRAVIMETRIC

Many factors determine the proper type of alum feeder for a particular application or installation. Quantity to be fed, accuracy requirements, storage capacity requirements, storage location, best available feeder location, feeder accessories desired — these and many more must be considered. B-I-F has a wide range of stock feeders designed to meet individual requirements.

DISC

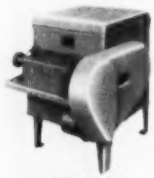
B-I-F also provides automatically regulated feeders for both dry and liquid alum for integration into continuous, controlled processes. When desired, totalizers keep an accurate record of alum fed.

B-I-F's Omega Feeder line is the most extensive available for feeding Alum. The following chart is a preliminary guide for determining the feeder which best suits your feeding accuracy, capacity, and range specifications. Send B-I-F your specifications . . . we have a feeder to meet your needs!



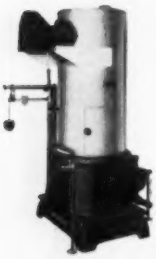
DIAPHRAGM PUMP

Auxiliary equipment and instrumentation: Omega augments its feeder line with totalizers, master control panels, remote controls, proportional pacing systems, alarms, batch counters, and other related units. Request details.



ROTODIP

CLASS OF FEEDER	FEEDS ALUM—	FEEDING PRINCIPLE	SIZES	ACCURACY	CAPACITIES MIN.	CAPACITIES MAX.	RANGES WITHOUT CHANGE GEARS
Model 30 Loss-in-Weight	DRY	GRAVIMETRIC	3	± 1% by weight	10 #/hr.	4000 #/hr.	100:1
Model 50-B Belt	DRY	GRAVIMETRIC	1	± 1% by weight	100 #/hr.	3000 #/hr.	100:1
Model 37-20 Belt	DRY	GRAVIMETRIC	1	± 1% by weight	500 #/hr.	2000 #/hr.	100:1
Model 30A Disc	DRY	VOLUMETRIC	1	± 3% by weight	40 cu. in./hr.	800 cu. in./hr.	20:1
Model 51 Disc	DRY	VOLUMETRIC	1	± 3% by weight	40 cu. in./hr.	6 cu. ft./hr.	100:1
Model 20 Universal	DRY	VOLUMETRIC	3	± 3% by weight	30 cu. in./hr.	85 cu. ft./hr.	40:1
Model 32 Loss-in-Weight	LIQUID	GRAVIMETRIC	3	± ½% by weight	5 #/hr.	60,000 #/hr.	25:1
Model 65 Rotodip	LIQUID	VOLUMETRIC	1	± 1%	5 GPH	1800 GPH	100:1
Model 47 Chem-O-Feeder	LIQUID	VOLUMETRIC	3	± 1% by weight	0.2 GPH	49 GPH	



UNIVERSAL

FREE BULLETINS:

B-I-F know-how and experience gained from thousands of performance-proved installations are available to you. For Bulletins describing any of the Feeder classes listed in the table, write **B-I-F INDUSTRIES, INC., Dept. U, 387 Harris Avenue, Providence 1, R. I.**

B-I-F

B-I-F INDUSTRIES

BUILDERS-PROVIDENCE · PROPORTIONEERS · OMEGA

FIRMS . . .

to annual capacity of the mill, bringing capacity to 200,000 tons/yr.

Air Reduction has completed a new oxygen and nitrogen plant at Denver, Colo.—its first major plant in the area. Capacity and cost of the new unit were not announced.

Haynes Stellite, division of Union Carbide, has installed a 2,000-ton forging press at its Kokomo, Ind., plant for shaping ingots of firm's "space-age" alloys — capable of withstanding corrosion at temperatures in excess of 2,000 F.

British American Oil is upping the raw gas capacity of its gas processing and sulfur plant at Pincher Creek, Alta., (*Chem. Eng.*, April 20, 1959, pp. 148-151) from 120 to 180 MMcf./day. Improvements will enable plant's three sulfur units to operate at full capacity of 675 long tons/day.

Talco Engineering Co. of Mesa, Ariz., is considering construction of a $600,000 plant for production of rocket fuel. Subsidiary operation, known as Rocket Power, Inc., would make fuel for the rocket engines which the firm manufactures.

Western Gypsum, Ltd., is planning a $2-million plant near Vancouver, B. C., that would manufacture 40 million sq. ft. of wallboard each year. Plant would receive its raw mate-

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MAGNETIC GAGE

For Liquid Levels

An important advancement in liquid level observation for plants with dangerous explosive or inflammable conditions.

Safety design seals against escaping gases.

Measuring mechanism in stainless steel chamber.

Scale mounted outside chamber; magnetically actuated through chamber wall.

Distinct, accurate level shown in red contrasted with silver above.

Job designed, correlating pressure, temperature, and specific gravity.

Available with electric alarms.

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Can also be used for interface indication.

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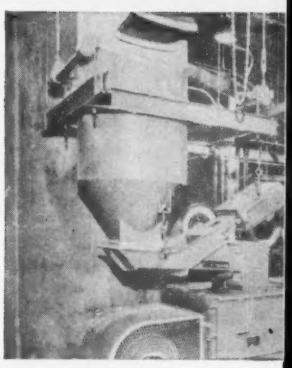

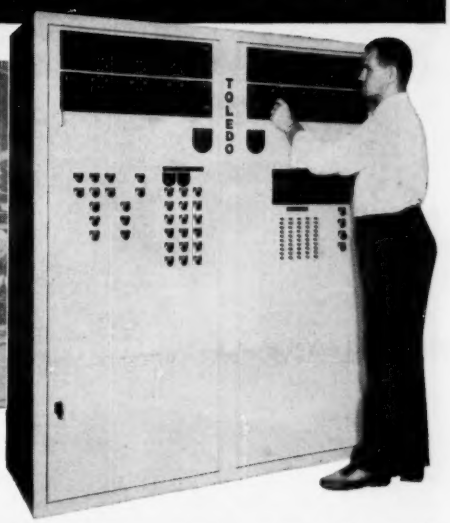

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REMOCON

SYSTEMS... provide Automatic Remote Control of single or multiple scale batching systems!

Control at a convenient remote location is yours with Toledo Remocon. Scale cutoffs adjust instantly for the proportioning requirements of each batch formula . . . no manual adjustments at scales required.

Flexibility allows setting up one formula while another is batching. Any portion of a batch may be run without resetting. Up to 20 or more ingredients can be cumulatively batched into a single weigh hopper. Formulas may be introduced by punch-card or batch board. Weight data may be recorded remotely.

WRITE TODAY for our Bulletin 2964 on modern Toledo Batching Equipment . . . or for specialized help from our Custom Products Engineering Group in solving your problems in batching, weight data processing, counting or classifying.

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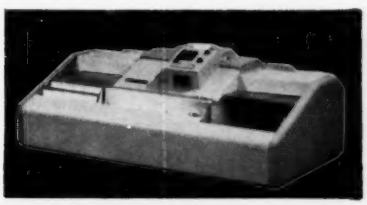
Toledo 12, Ohio

Headquarters for Weighing Systems

AUTOMATIC CHECKWEIGHING

Continuous, 100% in-line checkweighing of items from 50 to 200 lbs. at speeds to 40 per minute! Handles sacks, cartons, packages, pieces, parts. Motorized belt—fits into conveyor lines. Numerical counters, remote indication, other features. Ask for Bulletin 2968.

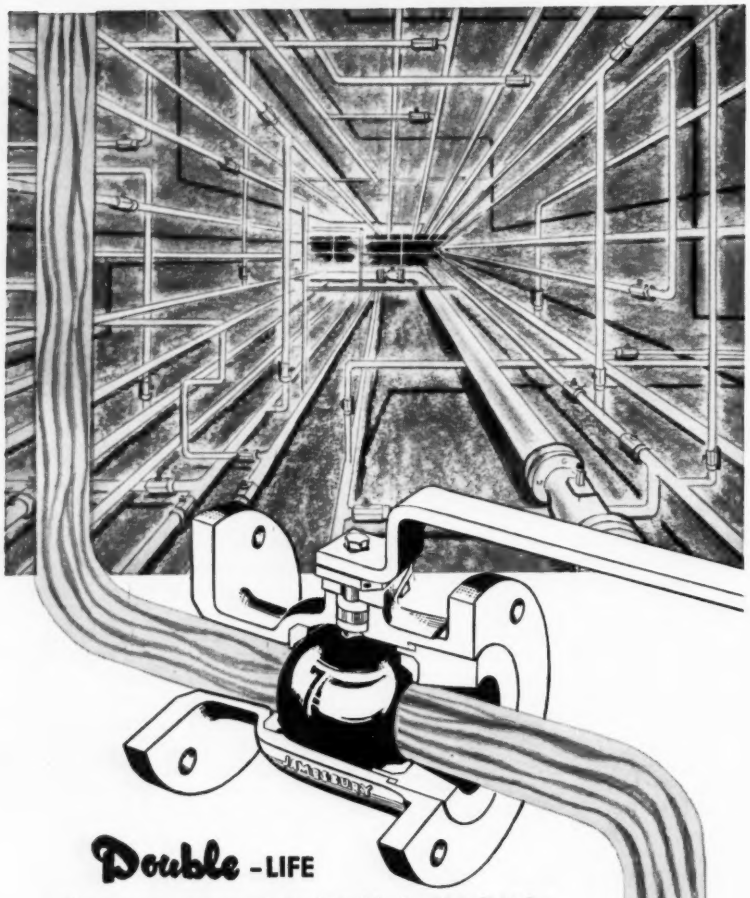


DATA PROCESSING

Weight data and figures can be transmitted from scales to any remote location—to be typewritten, numerically listed and totaled, stored for delayed recording, recorded by tape punch or introduced into a data processing system—all automatically!

jamesbury "Double-Seal" Ball Valves

Give Double-Value



Double-LIFE

The unique concept of the "Double Seal" Ball Valve itself spells far less wear, far less care, much more useful life.

Ball valves in pipe sizes ¼" to 8" in Bronze, Aluminum, Stainless Steel, Carbon Steel and PVC. Quarter Turn.

Distributors In Principal Cities.
Get The Complete Facts On The Jamesbury "Ball Valve" Principle.

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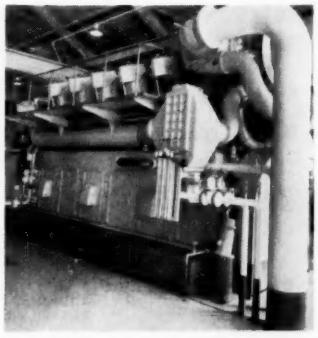
JAMESBURY CORP., 75 NEW STREET, WORCESTER, MASS.

rial from the British Columbia interior.

E. F. Houghton & Co. has opened a new plant in Carrollton, Ga.—its seventh in this country. Among plant's products are defoamers for paper mills and conditioning agents for textile industry.

Federal - Radorock - Gas Hills Partners is building a $3-million uranium mill at Riverton, Wyo., with capacity of 522 tons/day ore. Construction follows signing of a contract with the AEC providing a firm market for uranium concentrates through Dec. 31, 1966.

Dixon Chemical is building a new bulk sulfuric acid terminal at Fall River, Mass., to supply the New England area. Terminal will have a capacity of 3,200 tons and will have blending facilities to make any grade of sulfuric when it comes into operation on July 1.

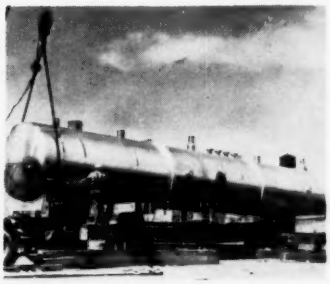


Cooper-Bessemer will install six large gas-engine compressors (like the one shown above) in the new helium extraction plant being built for the Bureau of Mines at Keyes, Okla. Machines will compress the helium-bearing natural gas to "extremely high pressures" prior to helium extraction.

K. C. Irving interests are reportedly planning construction of a $7-8 million caustic-chlorine plant in the St. John, N. B., area. Initial construction is expected to start this

year with the plant going into operation by 1961.

Diamond Alkali has a $450,000 expansion under way on its technical service and applications laboratory at Painesville, Ohio. Project will add 5,000 sq. ft. to firm's research center at Painesville.



Griscom-Russell is delivering what is called the "world's longest" evaporator for the Indian Point, N. Y., atomic power plant. The 65-ft., 87,000-lb. evaporator will produce 65,000 lb./hr. of steam at 62 psia. to provide nearly perfectly pure water (less than 0.25 ppm. impurities) for the station's power plant.

Dow Agrochemicals, Ltd., will build a plant in King's Lynn, Norfolk, England, to manufacture Dowpon (a selective grass killer) under license from Dow. Initial investment will be around $2 million.

Cargill, Inc.'s recently announced soybean oil and meal plant at South Norfolk, Va., will employ the Rotocel solvent extraction system supplied by the Chemical Plants Div. of Blaw-Knox.

Epsco-West, division of the Boston data control firm, has moved into a new $150,000 plant near Anaheim, Calif. Building includes facilities for production of high-speed analog and digital data handling systems for military and industrial uses.

Bemis Bro. Bag Co. is erecting a new plastic bag plant at Union City, Calif., for extrusion of polyethylene liners

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CHEMLON®

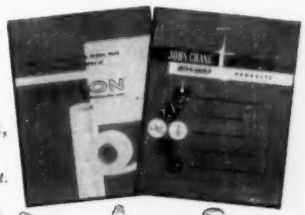
The Best In Teflon

It's a matter of good precaution—Getting the full advantages of this material depends largely on the processing ability of your supplier. He must meet *all* of these qualifications:

1 Fabricating experience, facilities and rigid quality control to supply a uniform, non-porous Teflon, free from any flaws, thus eliminating costly rejects or malfunction of your end product.

2 Dimensional accuracy—no matter what form you order, it should be carefully sized to industry specifications. Any waste of Teflon adds substantially to its cost, and corrective finishing in your own shop unnecessarily adds production time and expense.

Under the name, Chemlon, "John Crane" gives you full satisfaction on each of these points, plus engineering assistance on any problem you might have.



Contact "John Crane" about your specific needs. Also ask for Bulletins T-110 and T-122.

Crane Packing Co., 6451 Oakton Street, Morton Grove, Illinois, (*Chicago Suburb*)
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

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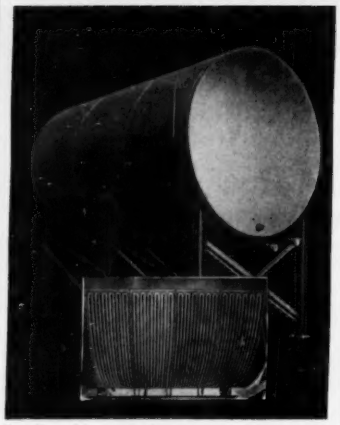
OFFICES IN ALL PRINCIPAL CITIES

This TANK is HEATED without PIPE COILS



In the foreground you see a modern, curved,

DEAN® THERMO-PANEL COIL

which, today, TAKES THE PLACE of old-fashioned pipe coils by doing a much better job.

Complete data and prices re Dean's latest models—assuring further INCREASED CAPACITY—are yours for the asking.

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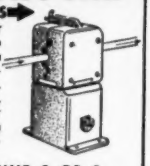
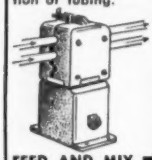
PUMPING IDEAS
POSSIBLE ONLY with a
SIGMAMOTOR PUMP

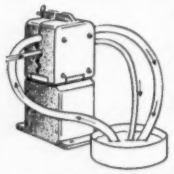
MOVE CORROSIVE LIQUIDS
Material being pumped never comes in contact with pump mechanism. Wave-like motion of steel fingers forces material through Tygon tubing. By changing size of tubing, capacity can be increased or decreased. Pump housing opens for removal and insertion of tubing.



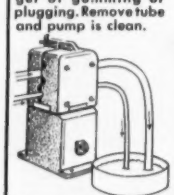


PUMP 2 OR 3 DIFFERENT LIQUIDS SIMULTANEOUSLY
Some models will accommodate up to four tubes so that four different liquids can be passed through the pump at one time without danger of contamination.

FEED AND MIX
One or more tubes can be feeding material to a mix while a larger tube is recirculating the liquid to produce agitation and thorough mixing. Viscous materials can be pumped without danger of gumming or plugging. Remove tube and pump is clean.



METER ADDITIVES
One or more additives can be pumped to a solution in the exact amount desired by selecting the correct size of tubing and regulating pump speed. Various controls can be incorporated to close valves ahead of pump.



Capacities from 0.5 cc. per min. to 4.5 G.P.M.
Write for complete information on sizes, capacities.

SIGMAMOTOR, INC.
17 N. Main Street • Middleport, N. Y.

FIRMS . . .

and manufacture of plain and printed polyethylene bags. New plant will begin operations about June 30.

Walker Process Equipment, manufacturer of water and waste treatment equipment, recently added 13,000 sq. ft. to its manufacturing facilities at Aurora, Ill.

Dow has placed in operation the first storage terminal in the St. Louis area for 50% caustic soda for supplying markets in Illinois and Missouri.

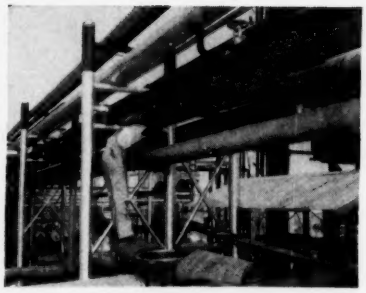
Du Pont's Film Dept. is making a major expansion of its Chestnut Run sales development and customer service laboratory near Wilmington, Del. New laboratory will cost more than $1 million and when completed in early 1960 will house about 140 persons.

Norton Co.'s Refractories Div. is expanding facilities at Worcester, Mass., for production of alumina, stabilized zirconia and other high-temperature refractories. Lindberg Engineering Co. is supplying kiln capable of sustained operation at 3,240 F.

Collier Carbon & Chemical Corp. has acquired all outstanding stock of Chemical Fertilizer Co., Modesto, Calif. Chemical Fertilizer will retain its corporate identity and will continue marketing under its own labels.

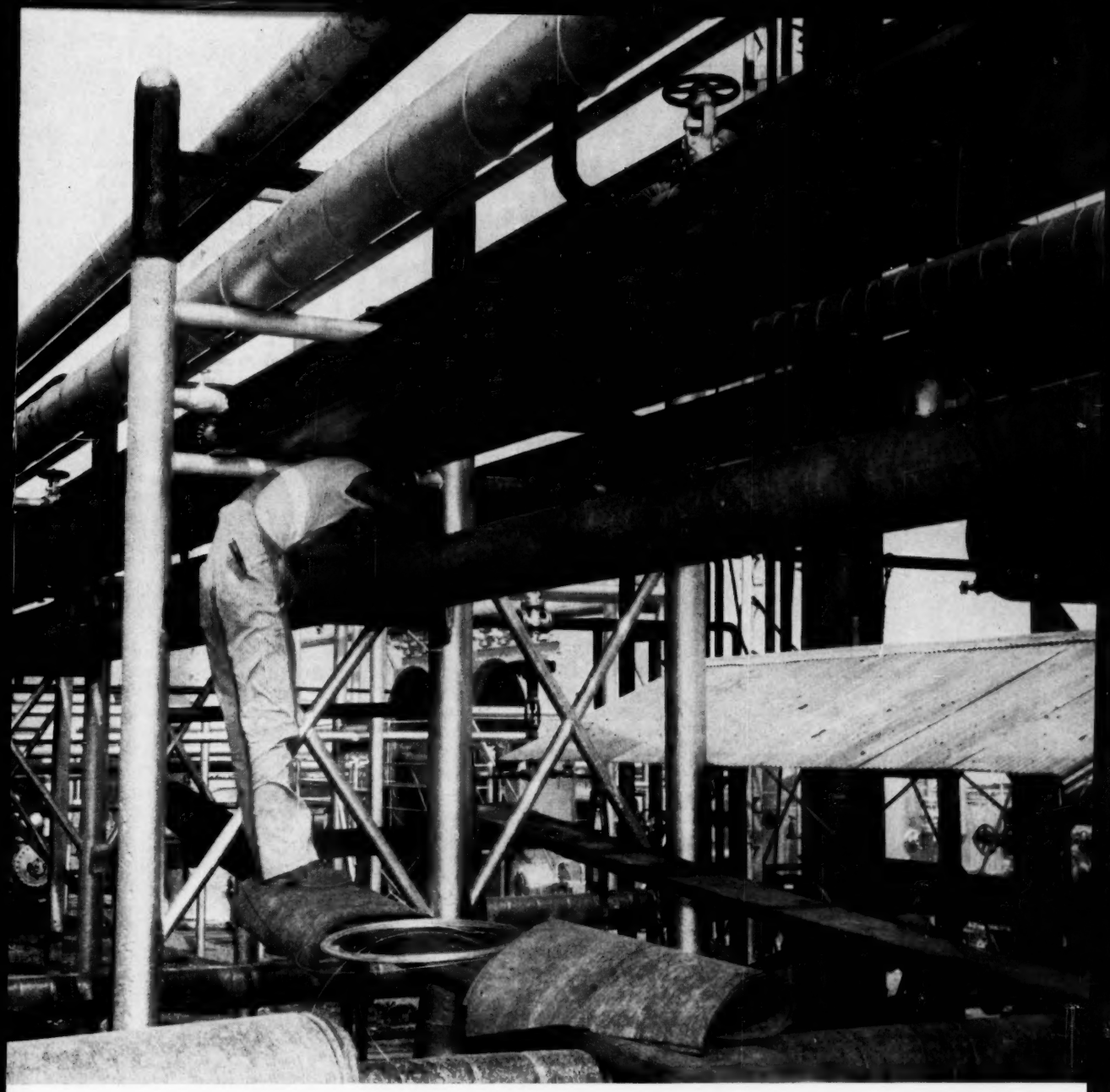
Wulff Process Co. has purchased from Koppers Co. rights to the production of acetylene and ethylene under U. S. and foreign patents covering inventions of the late R. L. Hasche.

Timken Roller Bearing Co. has offered to buy the shares of



G-B SNAP*ON DISTRIBUTORS
(See ad on facing page)

AKRON, Ohio, The Asbestos Supply Co.
ALBANY, Ga., Industry Insulation Co.
ALBUQUERQUE, Mt. States Insulation Co.
AMARILLO, McDonald Engineering & Insulating Co.
ATLANTA, Ga., Reynolds Aluminum Supply Co.
AUSTIN, Texas, Cinbar Engineering Co.
BALTIMORE, Md., Leroy Insulation Co.
BILLINGS, Mont., Big Horn Supply, Inc.
BIRMINGHAM, Ala., Shook & Fletcher Supply Co.
Reynolds Aluminum Supply Co.
BOSTON, Homans-Kohler, Inc.
BUFFALO, Industrial Insulation Sales, Inc.
CHARLESTON, W. Va., Baldwin Asbestos Products Co.
CHARLESTON HEIGHTS, S. C., Stafford Insulation Co.
CHICAGO, E. C. Carlson Co.
Culberg Asbestos & Cork Co.
CHILLICOTHE, Ohio, Southern Ohio Insulating Co.
CLEVELAND, Ohio Asbestos and Insulation Co.
COLUMBIA, S. C., Industrial Insulation
Div. of Richland Oil Co.
COLUMBUS, Culberg of Ohio
Santeler Brothers
CORPUS CHRISTI, Precision Insulation Co.
DALLAS, Insulation Supply Co., Inc.
Payne-Ladewig, Inc.
DAVENPORT, Republic Electric Co.
DENVER, Gene Wright Lumber Co.
Powers Industrial Insulation, Inc.
DES MOINES, Iowa Asbestos Co., Inc.
EL PASO, Insulation Specialties Co.
EVANSVILLE, Ind., George Koch Sons, Inc
FT. SMITH, Ark., Gunn Distributing Co
FT. WAYNE, Ind., M. H. Hilt, Inc.
FT. WORTH, The Bracken Co.
GREENSBORO, N. C., Starr Davis Co., Inc
GULFPORT, Miss., Paine Supply Co.
HOUSTON, Precision Insulation Co.
INDIANAPOLIS, Central Supply Co.
JACKSON, Miss., Paine Refrigeration & Supply Co.
JACKSONVILLE, Ferber Sheet Metal Works
Reynolds Aluminum Supply Co
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Central Supply Co.
LITTLE ROCK, Gunn Distributing Co.
LOS ANGELES, Thorpe Insulation Co.
Western Fibrous Glass Products Co
LOUISVILLE, General Insulation & Roofing Co
MACON, Ga., Industry Insulation Co.
MEMPHIS, John A. Denie's Sons Co.
MIAMI, Crabtree Insulation Co.
Reynolds Aluminum Supply Co.
Southern Metals Co.
MILWAUKEE, F. R. Dengel Co.
MINNEAPOLIS, Asbestos Products, Inc.
NASHVILLE, Reynolds Aluminum Supply Co.
NEWARK, N.J., Eastern Steam Specialty Co
NEW ORLEANS, Eagle Asbestos & Packing
NEW YORK, Eastern Steam Specialty Co.
Hudson Valley Asbestos Corp.
OKLAHOMA CITY, Ball Distributing & Engineering Co.
OMAHA, Cardinal Supply & Mfg. Co.
ORANGE, Conn., Insulation Supply Co.
PADUCAH, Ky., Triangle Insulation Co.
PHILADELPHIA, John F. Scanlan, Inc.
PHOENIX, Ariz., Kircher Asbestos & Rubber Co.
PITTSBURGH, Dravo Corp.
PORTLAND, ORE., Western Fibrous Glass
RALEIGH, N.C., Reynolds Aluminum Supply Co.
RAPID CITY, S. D., Robbins & Stearns Wholesale
RICHMOND, Va., Reynolds Aluminum Supply Co.
ROANOKE, Va., C. E. Thurston Co.
ROCKFORD, Ill., Mott Brothers Co.
SALT LAKE CITY, Bullough Asbestos Supply Co
SAN ANTONIO, The Bracken Co.
SAN DIEGO, Western Fibrous Glass Products
SAN FRANCISCO, Western Fibrous Glass Products
SAVANNAH, Ga., Reynolds Aluminum Supply Co.
SEATTLE, Western Fibrous Glass Products
ST. LOUIS, Hollander & Co., Inc.
The Stovey Company, Inc
ST. PAUL, Asbestos Products, Inc.
SULLIVAN, Ill., Lewie David, Inc.
TALLAHASSEE, Fla., Bakers, Inc.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc
TULSA, Okla., Ball Distributing & Engr. Co.
TUPELO, Miss., Paine Supply Co.
VANCOUVER, B. C., Fleck Brothers Limited
WASHINGTON, D. C., Walter E. Campbell Co
WICHITA, General Metals, Inc.



They compared "K" factors and cost factors ...and bought SNAP*ON®

Here's how <u>you</u> can reduce the cost of insulating a maze of piping— simply use Snap*On, the original one-piece insulation molded of fine glass fibers. Featherweight 3′ and 6′ Snap*On sections snap over pipe in less time than it takes to tell. Snap*On is flexible, has a resilient toughness that makes it easy to handle and apply in tight spots and close quarters . . . without breakage. And there's no waste.

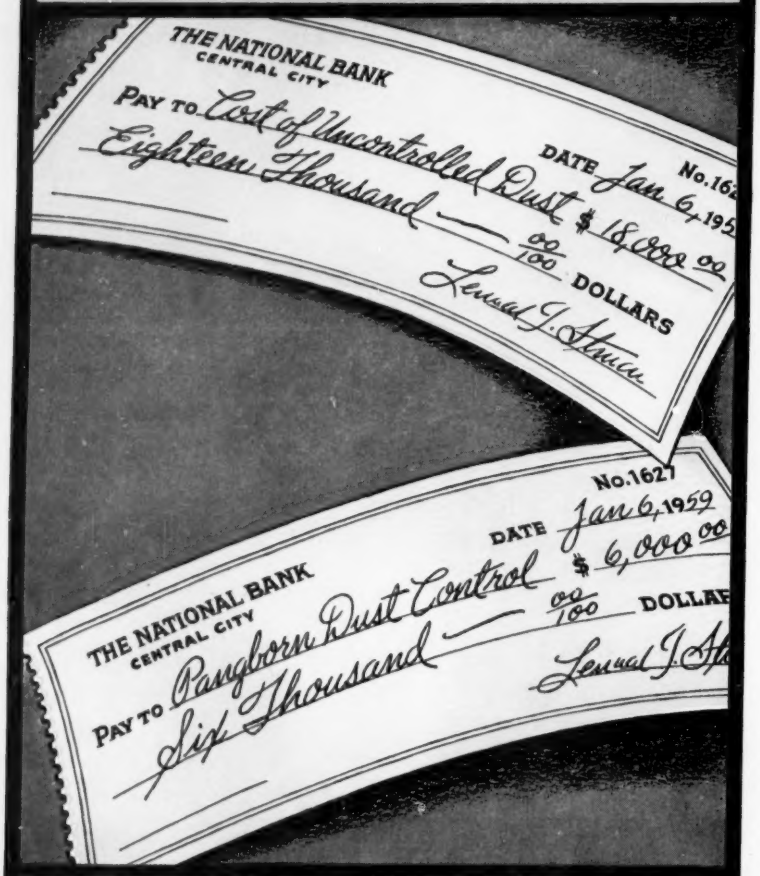
So outstanding is thermal efficiency that 1½″ Snap*On is thermally superior to most 2″ insulations — more permanent, too. Just ask your local G-B Snap*On distributor to make a TEVA (Thermo-Economic Value Analysis) survey of your pipe insulation requirements — and you will agree there is *nothing* like Snap*On!

YOUR LOCAL G-B SNAP*ON DISTRIBUTOR IS

GUSTIN-BACON *Manufacturing Co* GUSTIN gb BACON

252 W. 10TH ST., KANSAS CITY, MO.

WHICH CHECK WOULD YOU RATHER WRITE?



How much are you paying for uncontrolled dust?

See for yourself—add up the cost of your lost salvageable material, housekeeping expenses, excess machine wear, intangibles such as community and employee goodwill. Whether your total is moderate or high, Pangborn Dust Control will cost you *less* than uncontrolled dust.

For details on Pangborn's engineering knowledge and experience, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 2600 Pangborn Blvd., Hagerstown, Maryland. *Manufacturers of Dust Control and Blast Cleaning Equipment — Rotoblast® Steel Shot and Grit.*

Pangborn CONTROLS DUST

FIRMS . . .

British Timken, Ltd., owned by minority holders. The American company presently holds more than half of the common shares.

Hooker Chemical Corp. has formed a Bahamian corporation, Hooker Chemical International, Ltd., to engage in chemical manufacturing and marketing activities in Latin American countries.

Leon Chemical Industries is a new company manufacturing acrylic coatings for glass and metals, paint intermediates and formulated epoxy. Headquarters is at 2841 E. Eleven Mile Rd., Warren, Mich.

Francis H. Snyder & Associates, New Milford, Conn., has undergone a corporate realignment, naming several new officers; firm will continue and expand its original chemical engineering and research development business.

North American Aviation and Foster Wheeler have reached an agreement whereby North American would acquire the engineering and construction firm through an exchange of stock. Acquisition will be voted on by stockholders of both companies early in July.

OVERSEAS BRIEFS

Argentina's new chemical firm, Fabrica Argentine de Hidrosulfita y Afines (joint subsidiary of BASF and Compania Quimica) is now in production of textile dyestuffs and bleaches using BASF processes. Production is sufficient to meet total Argentine demand.

Peru now has a new source of synthetic fertilizer — a $10-million plant in Callao built by Fertilizantes Sinteticos, S. A. Using Fauser-Monte-

Switch Costly Mixing Operations to a Paying Basis with CONTROLLED DISPERSION

There's nothing new about controlled dispersion . . . except the growing need for it.

A Familiar Mixing Dilemma

If you mix dry solids or semi-solids, chances are you have felt this need first hand—in the squeeze between rising material costs and increased "front office" demands for better, more uniform blends—faster and with less material waste.

That's a big order and more and more processors have found that it's *too* big to be met with obsolete mixing equipment. It takes *more* than a simple stirring, tumbling an agitator action *can give*—to produce a blend of materials that is capable of converting a red figure mixing operation into a *new source for profit control.*

The Mulling Principle

The Simpson Mix-Muller is *specifically designed* to *put you in control* of mixed properties. You get a unique, three-way kneading, smearing, spatulate action which actually coats one material with the other, rather than placing components *next* to each other. An intensive, but controlled, mulling action eliminates balling, breaks up agglomerates and provides unparalleled control over the dispersion of moisture, binders, carriers, etc. You get an *intensive*, homogenous mix that *stays* mixed in storage or transit.

How Mulling Pays Its Way

Most important . . . you get a mixer that can quickly *pay for itself* by eliminating reprocessing and remixing, slashing waste and rejects. With a Mix-Muller in the key spot, you can join the hundreds of enlightened processors who have turned problem mixing operations into new profit *opportunities.*

Want Proof?

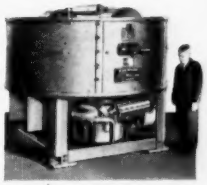
A list of Mix-Muller users will be sent upon request—together with the *Handbook on Mulling* or, write for details on a confidential *mulling* survey of your product . . . conducted under strictest laboratory conditions.

Mix These Two Materials in these amounts . .
And Get This even texture, thorough moisture dispersion
Not This "Hot spots" balling, uneven and wasteful dispersion.

Here's how *controlled mulling* works:

Diagram shows comparative results of blending a minute amount of one material with large amount of another material in (A) MIX-MULLER and (B) conventional mixer. Savings in raw material, reprocessing time and quality of finished product are the outstanding *rewards* of mulling your product.

Simpson Mix-Mullers are available in batch capacities of from ½ to 60 cubic ft. They can be equipped for heating, cooling or chemical interaction during mixing and can be furnished in stainless, alloys or other special materials or linings.



MODEL 3F MIX-MULLER 60 cu. ft. capacity

LABORATORY MODEL ½ - ¾ cu. ft. capacity

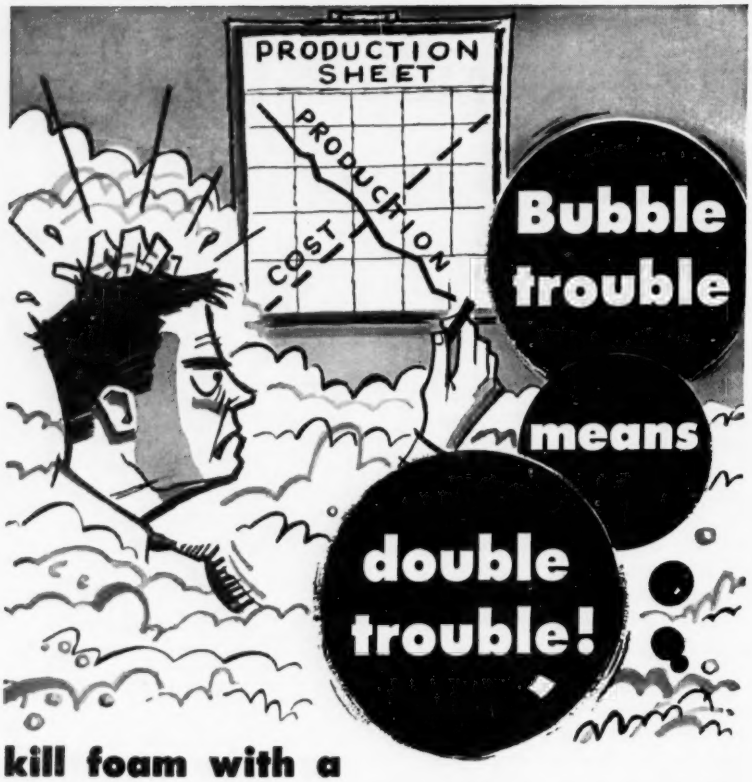
SIMPSON *MIX-MULLER* DIVISION
National Engineering Company
636 Machinery Hall Building • Chicago, Illinois

HOW MULLING gives you controlled dispersion for better blends:

GOING: Mix is wetted, dispersion of coating media begins as lumps form.

GOING: Smearing, *spatulate* action breaks up lumps as mulling action disperses moisture.

GONE: Agglomerates almost gone as blending nears completion. Mix is homogeneous, thorough.



kill foam with a Dow Corning SILICONE DEFOAMER

Is foam giving you the old "one-two"? One—slowing up your processing . . . two—running up your costs? Fight back hard. Knock out foam fast, with Dow Corning silicone defoamers . . . most efficient foam killers known!

1 oz kills foam in:

3,125,000 lb cellulose slurry

62,500 lb hypo fix and film developer

6,250 lb acetic acid-wood alcohol distillation mix

FREE SAMPLE! Make your own test. Return coupon below for generous *trial sample* of a Dow Corning SILICONE DEFOAMER. No obligation, of course.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

2617

NAME

TITLE

COMPANY

CITY ZONE STATE

My foamer is

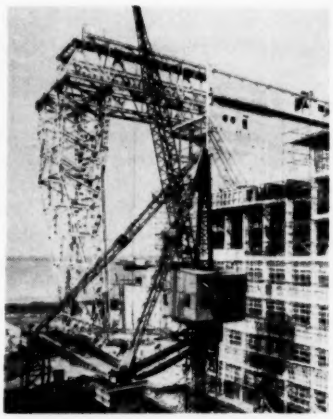
Oil system

Aqueous system

Food products

Other

catini processes, the plant can anually produce 20,000 metric tons of anhydrous ammonia, 54,000 metric tons of 53% nitric acid, 35,000 metric tons of ammonium nitrate, 7,000 metric tons of ammonium sulfate and 1,500 metric tons of 98% nitric acid.



Britain's new 300 mw. nuclear power station at Bradwell, Essex, is rapidly taking shape. The 185-ft. bridge crane shown straddling the construction site is said to be the largest of its kind in the world.

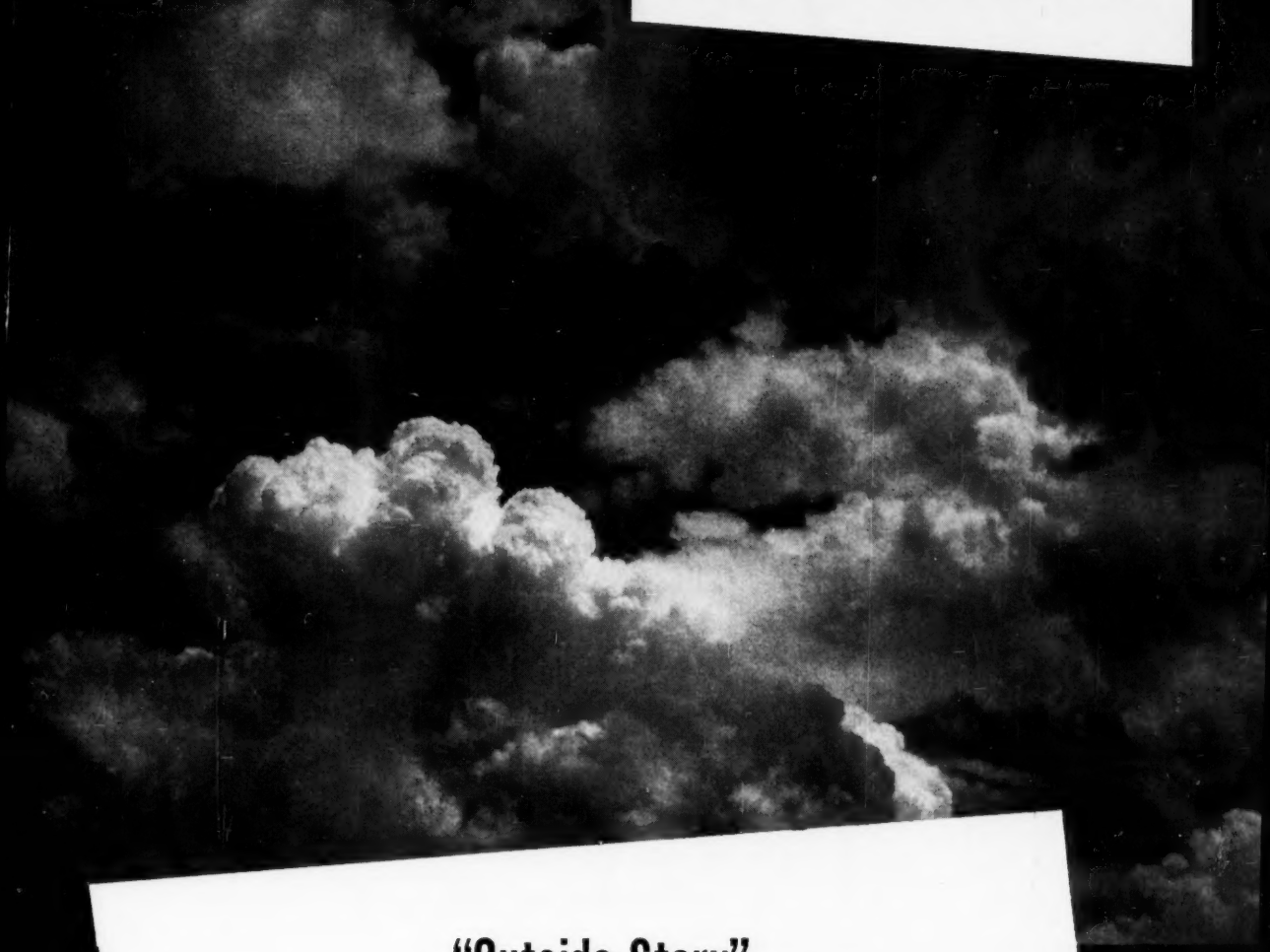
India has asked one of France's leading electrometallurgical companies, Ugine, to submit detailed plans for India's first specialty steel plant; initial capacity would be around 40,000 tons/yr. Ugine is competing with a British combine composed of English Steel, Thomas Brown and Firth Vickers.

NEW LOCATIONS

Atlas Powder is moving its Thermaflow plastic molding compounds manufacturing operations from Tunkhannock, Pa., to its Atlas Point plant near Wilmington, Del. Consolidation will result in the

SCOPE in INDUSTRY
SPECIALIZATION from...

ALLIS-CHALMERS



an "Outside Story" about
Allis-Chalmers products

Self-protection against weather is built into a variety of Allis-Chalmers products — electrical or mechanical. This "Outside Story" through a broad range of A-C equipment (and only A-C offers such a scope of outdoor products) *eliminates the need for costly protective enclosures in many operations.*

Pumps, motors, compressors, mechanical drive equipment, control and switchgear with inspection alleys — all are designed to perform 'round the calendar while exposed to the elements.

For single-source availability of a tremendous scope of up-to-date equipment, designed for outstanding quality control, contact your A-C representative. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Products for the Chemical Industry: Electrical Generation and Distribution Equipment; Pumps (rotary vacuum and centrifugal); Motors and Control; Mechanical Power Transmission Equipment; Processing Machinery (mills, kilns, screens, etc.); Water Conditioning Systems, plus Materials Handling Equipment.

A-C ALLIS-CHALMERS

A-5917-C

. . . higher meta content to give you more speed, lower unit cost in phenolic resin applications

PITT-CONSOL Meta Para Cresol offers 2.7 parts of meta to every one of para! That's more meta cresol (over 70%) than most mp cresols on the market . . . and the big reason why it provides a faster cure in brake linings, varnishes, molding compounds and many other phenolic resin applications. Investigate the advantages of PITT-CONSOL Meta Para Cresol . . . Available in 2° and 3° grades of high purity and closely controlled uniformity.

• For any cresylic acid with the quality and performance you seek look to Pitt-Consol first. Send for a brochure covering the complete line or consult our insert filed in Chemical Materials Catalog.

"Expanding cresylics to further industry"

PITT-CONSOL CHEMICALS

PITT-CONSOL
Chemical Company
191 DOREMUS AVE. • NEWARK 5, N. J.

A SUBSIDIARY OF CONSOLIDATION COAL COMPANY

FIRMS . . .

closing of the Tunkhannock plant effective July 1st.

U.S. Steel has established a sales office in Anaheim, Calif., to market coal chemicals such as benzene, toluene, xylene, tar products, ammonia and nitric acid—most of which are produced at the Geneva Works at Provo, Utah.

Thompson - Ramo - Wooldridge Products Co. has opened an eastern sales engineering office at 200 E. 42nd St., New York 17, N. Y.

NEW LINES

Hydrodyne Corp. has organized The Skinner Filter Division to develop a line of filters for aircraft and special applications; production is already under way at the North Hollywood, Calif., plant.

Milton Roy Co., Philadelphia, Pa., has signed a 10-yr. licensing agreement with Electronic Instruments, Ltd., Richmond, Surrey, Eng., for manufacture and sale of industrial and laboratory pH equipment in the U.S.

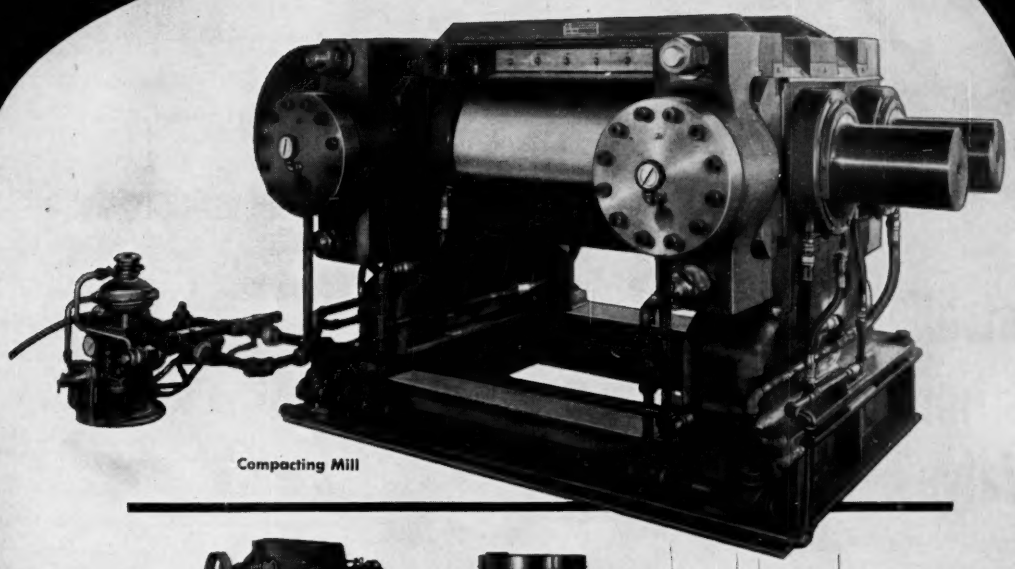
NEW REPRESENTATIVES

Chicago-Wilcox Mfg. Co., Chicago, Ill., has been appointed servicing distributor for U.S. Rubber packings covering all lines such as sheet, pump, asbestos, canvas, expansion, metallic and Teflon packings.

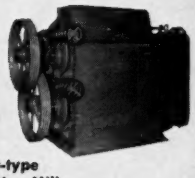
California Mill Equipment Co., San Mateo, Calif., is now the representative in California, Arizona and Nevada for Dura-Bukets manufactured by National Oats Co.

SCOPE in INDUSTRY
SPECIALIZATION from...

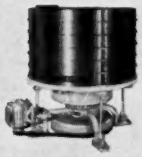
ALLIS-CHALMERS



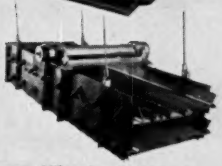
Compacting Mill



Roller-type
Granulating Mill



Gyratory Screen

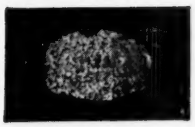


Vibrating Screen

Allis-Chalmers compacting process

Rescues "Lost" Profits

...converts waste chemical fines into a salable product



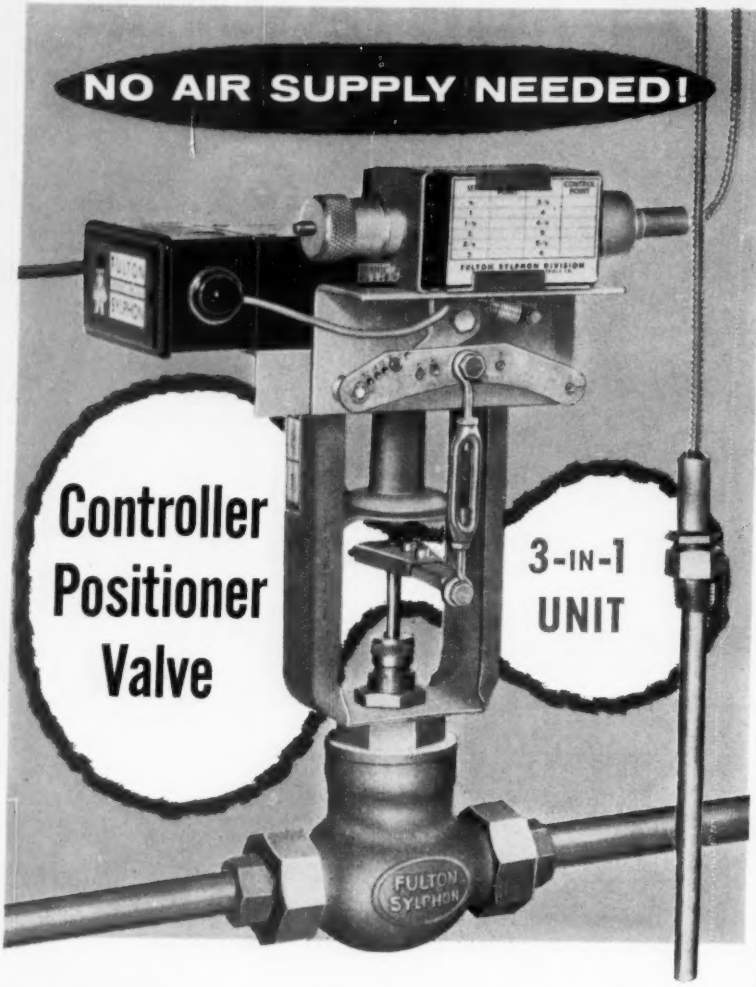
A potash producer salvages seven tons per hour from sub-sized fines. A chemical salt manufacturer effects an 80% recovery of marketable material. Yes, waste becomes valuable when put through the Allis-Chalmers compacting process.

The compacting system is a package of integrated Allis-Chalmers equipment — the remarkable new compacting mill, a roller mill and either a gyratory or vibrating screen. The compacting mill mechanically densifies fines created in your original process. The resulting flakes or slabs are granulated in the roller mill and separated in the screen. Precise control of particle size, density and solubility factors is assured. Recovered product equals or surpasses parent product in every respect.

Get Bulletin 07B8836 from your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

A-C
ALLIS-CHALMERS

A-5947



Complete, Pre-assembled Electric Modulating Unit Controls Process Temperatures at Less Cost!

Right on the heels of the recently introduced FultroMatic air-actuated unit, Robertshaw engineers perfect this electrically operated version, the FultroLectric.

This low-cost combination Controller-Positioner-Valve provides modulating control of critical processes at about one-half the cost of two- and three-unit systems.

- **Dependable accuracy:** element responds to minute changes
- **Positive valve positioning:** no overshoot
- **Adjustable proportional band** easily changed on the job
- **Simplified settings:** easily reproducible
- **Field reversibility** for changing control action
- **Easy to install:** place valve in line, mount bulb, connect power
- **Low maintenance:** rugged design for trouble-free service

For complete details and specifications, write for Bulletin JC-756

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tennessee

CALENDAR

Dechma annual meeting and presentation of Max Buchner Research awards, Palmengarten.
May 21-22 Frankfurt a. M.

Commercial Chemical Development Assn., annual resort meeting, Pocono Manor.
May 25-26 Pocono Mts., Pa.

Chemical Institute of Canada, 42cnd annual conference, Nova Scotian Hotel.
May 25-27 Nova Scotia, N. S.

American Society for Quality Control, annual meeting, Hotel Sheraton.
May 25-27 Cleveland, Ohio

Technical Assn. of the Pulp and Paper Industry, 10th Coating Conference, Statler Hotel.
May 25-27 Boston, Mass.

American Society of Mechanical Engineers, Design Engineering Conference, Convention Hall.
May 25-27 Philadelphia, Pa.

American Petroleum Institute, Refining Div. midyear meeting, Hotel Statler.
May 27-30 New York, N. Y.

Annual Industrial Research Conference, Columbia University, Arden House, Harriman Campus.
May 31-June 5 Harriman, N. Y.

Fifth World Petroleum Conference and Exposition, N. Y. Coliseum, See Chem. Eng., May 4, pp. 56-58 for listing of technical papers.
May 31-June 6 New York, N. Y.

American Material Handling Society, national conference, Cleveland Auditorium.
June 9-11 Cleveland, Ohio

Material Handling Institute, annual exposition, Cleveland Auditorium.
June 9-12 Cleveland, Ohio

Instrument Society of America, 2nd International Symposium on Gas Chromatography, Kellogg Center for Engineering Education.
June 10-12 East Lansing, Mich.

Manufacturing Chemists Assn., 87th annual meeting. The Greenbrier.
June 11-13 White Sulphur Spa., W. Va.

Technical Assn. of the Pulp and Paper Industry, New York Section, annual meeting, Whiteface Inn.
June 11-13 Lake Placid, N. Y.,

American Society of Mechanical Engineers, semi-annual meeting, Chase-Park and Plaza Hotels.
June 14-18 St. Louis, Mo.

American Nuclear Society, 5th annual meeting, Civic Auditorium.
June 15-17 Gatlinburg, Tenn.

Gordon Research Conference: Separation and Purification, Colby Junior College.
June 15-19 New London, N. H.

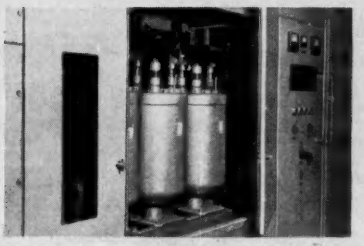
American Society for Engineering Education, annual meeting, Carnegie Inst. of Technology.
June 15-19 Pittsburgh, Pa.

(*Continued on p.* 218)

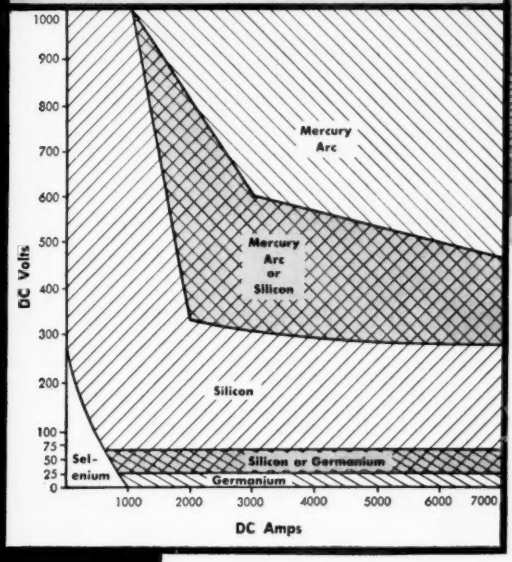
SCOPE in INDUSTRY
SPECIALIZATION from...

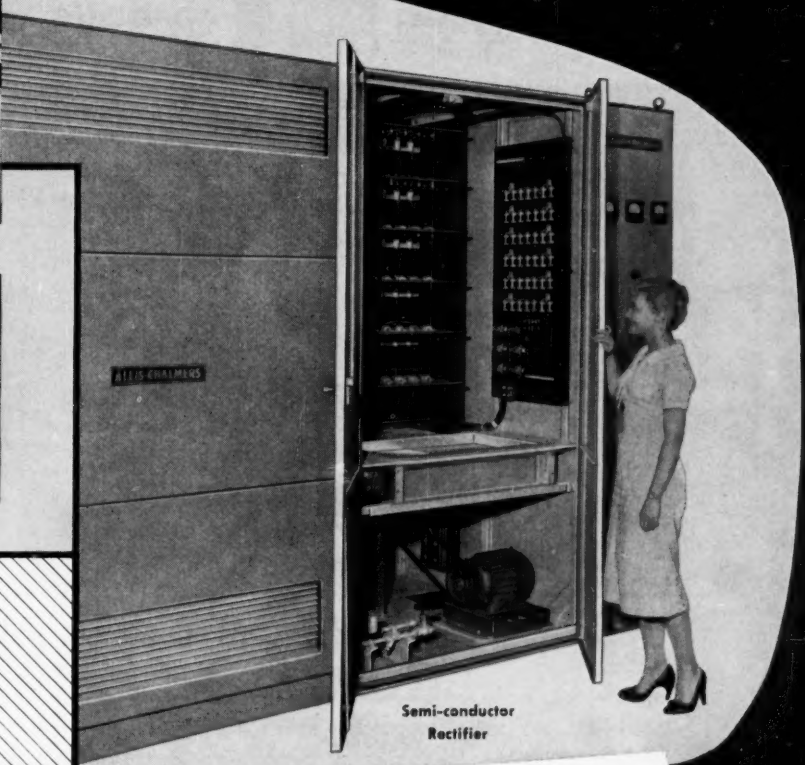
ALLIS-CHALMERS

Open pumped tube Mercury Arc Rectifier



Enclosed sealed tube Mercury Arc Rectifier





Semi-conductor Rectifier

Allis-Chalmers takes the confusion out of power conversion

Right-for-the-job rectifier

Available to Electrochemical Industries

There's only *one* type rectifier that's *right* for your electrochemical application. Use the above chart as a guide. It shows the approximate direct current and voltage ratings that best fit the various types of rectifiers. After checking the chart, check with Allis-Chalmers. Thirty years' experience in developing, building and applying rectifiers equips A-C to analyze your needs and make a pinpoint recommendation.

Allis-Chalmers makes all static types

Allis-Chalmers builds semi-conductor rectifiers such as germanium, silicon, and selenium, as well as mercury arc rectifier units of the pumped or sealed type in open or enclosed construction. Because Allis-Chalmers can supply this wide variety of power rectifiers, our recommendation is always completely unbiased — never influenced by commercial expediency. For complete information, call your A-C man or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

A-C ALLIS-CHALMERS

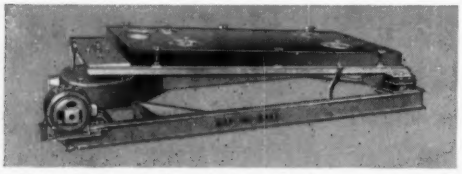
A-5955 C

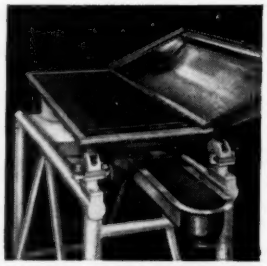
SIFT finer-faster-cleaner with DAY ro-balls

A few of more than 180 DAY ro-ball sifters in operation at a large midwestern plant.

Today thousands of products wet or dry, from flour to wood chips, are sifted through efficient, low-cost, high-production DAY ro-ball sifters. Superbly engineered, built for trouble-free operation under the severest service conditions, they insure longer life with lower maintenance costs.

The exclusive super active ball cleaning device provides rebound points in each ball compartment, assuring fast, thorough sifting of your product. Gyrating action brings material into constant contact with every square inch of screen surface. A stabilizer maintains screen in horizontal position and insures smooth operation.


DAY standard ro-ball, available in six sizes, single or multiple screens. Single screen models in stock.


Stainless steel units available to meet food and dairy sanitary codes.

Many models are available so it is easy to choose one which will exactly suit your requirements. They can be used separately or in combination with DAY mixers or blenders to save product handling. A completely equipped lab is available for testing your product.

Write for new DAY ro-ball Bulletin.

The **J. H. DAY** *Co.*

Division of The Cleveland Automatic Machine Co.

SERVING THE PROCESS INDUSTRY SINCE 1887

4926 BEECH STREET, CINCINNATI 12, OHIO

CALENDAR . . .

American Society for Engineering Education, annual meeting, Carnegie Inst. of Technology.
June 15-19 Pittsburgh, Pa.

Canadian Pulp and Paper Assn., Technical Section, summer meeting, Manoir Richelieu.
June 17-20 Murray Bay, Que.

National Society of Professional Engineers, annual meeting, Commodore Hotel.
June 17-20 New York, N. Y.

American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall.
June 21-26 Atlantic City, N. J.

Canadian Gas Assn., annual meeting, Empress Hotel.
June 22-24 Victoria, B. C.

Air Pollution Control Assn., annual meeting, Hotel Statler.
June 22-26 Los Angeles, Calif.

American Assn. of Cost Engineers, 3rd annual meeting, Carnegie Inst. of Technology.
June 24-26 Pittsburgh, Pa

Instrument Society of America, 2nd Nuclear Instrumentation Symposium.
June 24-26 Idaho Falls, Idaho

Forest Products Research Society, 13th national meeting, St. Francis Hotel.
June 28-July 3 San Francisco

Gordon Research Conference: Polymers, Colby Junior College.
July 6-10 New London, N. H

Society of Chemical Industry, 78th annual meeting.
July 6-11 Glasgow, Scotland

Foundation for Instrumentation Education-American Institute of Chemical Engineers, summer conference: process dynamics, Case Inst. of Technology.
July 6-24 Cleveland, Ohio

Gordon Research Conference: Organic Reactions and Processes, New Hampton School.
July 13-17 New Hampton, N. H.

Gordon Research Conference: Corrosion, Colby Junior College.
July 20-24 New London, N. H.

Gordon Research Conference: Radiation Chemistry, New Hampton School.
July 27-31 New Hampton, N. H.

Gordon Research Conference: Organic Coatings, Colby Junior College.
July 27-31 New London, N. H.

National Soybean Processors Assn.-American Soybean Assn., joint annual meeting, Sheraton-Jefferson Hotel.
Aug. 10-12 St. Louis, Mo.

American Pharmaceutical Assn., annual meeting. Netherland-Hilton Hotel.
Aug. 16-21 Cincinnati, Ohio

Gordon Research Conference: Chemistry and Physics of Metals, Kimball Union Academy.
Aug. 17-21 Meriden, N. H.

SCOPE of PUMP DEVELOPMENT from... **ALLIS-CHALMERS**

POXEAL insulation system of *Super-Seal* motors provides a stator completely impervious to contaminating elements. Result: A close-coupled pump with an open-type motor that can "take" the toughest atmospheres.

You can save up to 20% on close-coupled pumps

Capacities to 2500 gpm, heads to 550 ft.

Now from Allis-Chalmers: close-coupled pump units powered by *Super-Seal* motors with *Poxeal* insulation!

You can save up to 20% by specifying these units. Reason: Open-type *Super-Seal* motors may be used in many areas previously requiring more costly enclosed motors.

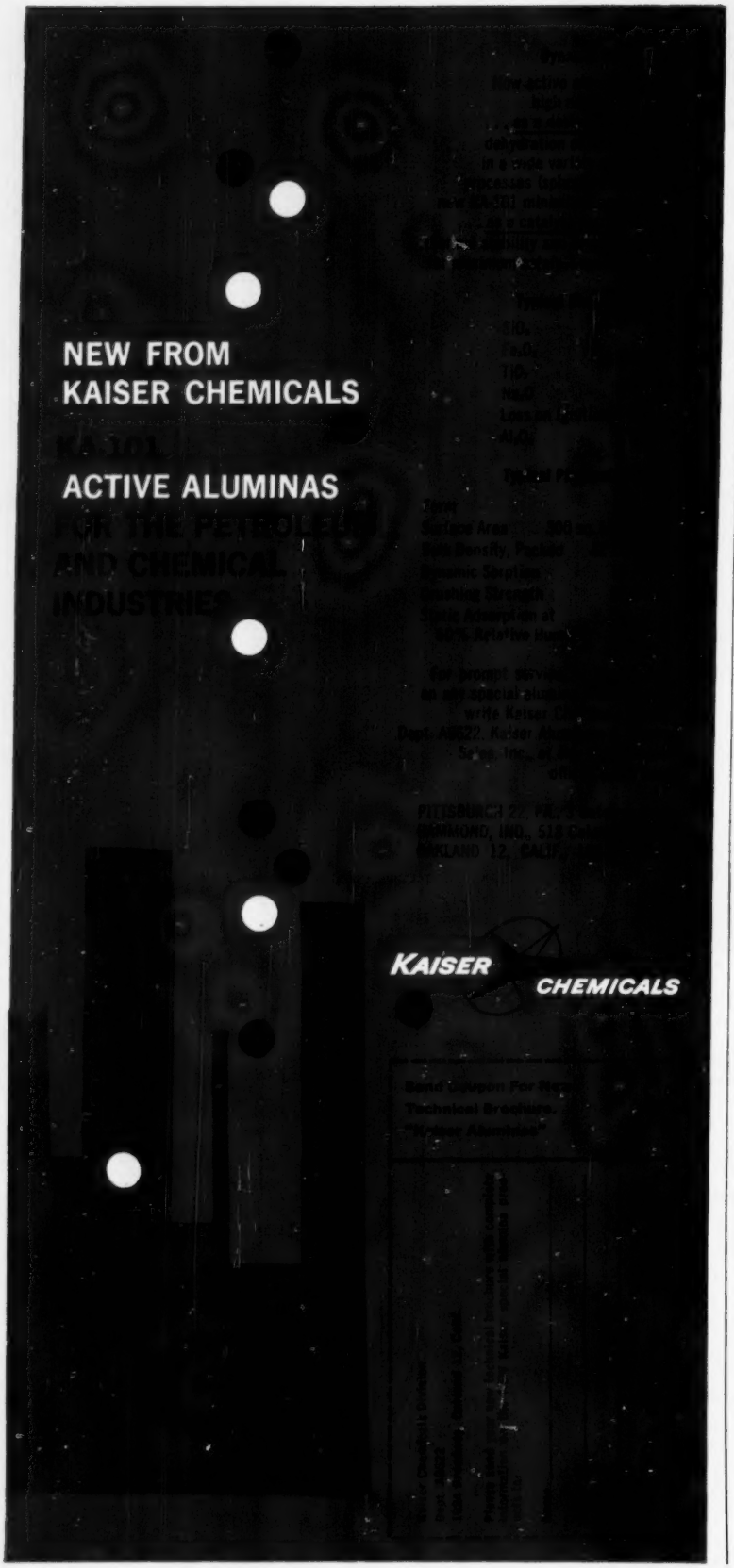
In addition to moisture-defying *Super-Seal* motors, these pump units offer heavy-duty construction, easily replaceable wearing rings, balanced impellers, plus other quality pump features. It all adds up to a cost-saving pumping package for a wide variety of installations.

Contact your A-C representative or distributor for coordinated pumping equipment — pumps, motors, control and drive. *Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.*

Super-Seal and *Poxeal* are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

A-5883-C



NEW EQUIPMENT . . .

(*Continued from p. 96*)

distillands having molecular weights ranging from 250 to 4,000. Thus, applications could include the processing of such heat-sensitive materials as glycerides of fatty acids, essential oils, pharmaceuticals, tall oil, epoxy resins, silicone oils, etc.

In both machines, distilland feeds to the center of a heated conical rotor spinning within a chamber held at a pressure ranging from 10 to 20 microns. Rotor speed is 350 rpm. for the 36-in. machine, and 425 rpm. for the 60-in. still.

Feed material spreads over the rotor in a thin uniform film. Close control of rotor temperature causes evaporation of the distilland's desired lighter fraction, which eventually collects on a water-cooled dome condenser. The unevaporated fraction slides off the rotor into a collecting gutter. Both fractions flow by gravity to the discharge pumps.

The vacuum systems utilize a manifolded KS-200 oil diffusion ejector pumping system, which may be manifolded to steam-ejector pumps or to gas-ballasted mechanical pumps. Ultimate pressure of the clean dry still is 5 microns.

Both machines come equipped with a complete control center that includes switches, circuit breakers, a temperature controller and recorder, and pressure-rise protection.

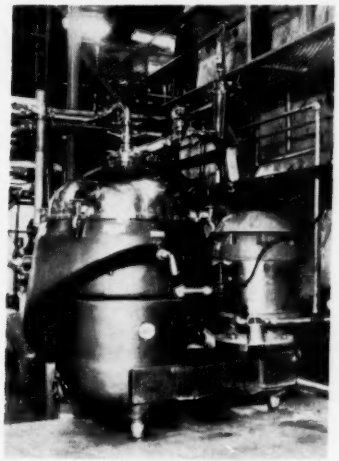
Operational costs for CEC's stills average $\frac{1}{10}$¢ to $\frac{1}{4}$¢ per pound of throughput. Model CMS-36 has a price tag of about $60,000; Model CMC-60 sells in the vicinity of $150,000—**The Consolidated Electrodynamics Corp., Rochester, N. Y.** 96E

Demonstration Package

Kit illustrates nylon tubing's properties.

A kit containing Plaskon nylon tubing is available at no cost to chemical and design engineers. The kit illustrates the tubing's high burst strength (at one-half the cost of metal

tubing), an important consideration for pneumatic systems, hydraulic controls and fuel lines. A 1-ft. sample of tubing measuring ¼ in. O.D. by 0.040 in. (wall thickness) is included. **—Plastics & Coal Chemicals Div., Allied Chemical Corp., New York, N. Y. 220A**



Continuous Centrifuge

Need not be shut down for bowl cleaning.

Field engineering tests have just been completed on a new high-capacity centrifuge designed for continuous liquid clarification, three-phase separation or recovery of valuable solids and liquids. Known as the SAN-15007 Automatic De-Sludger, the centrifuge expels sludge automatically.

In operation, the liquid stream feeds through a disk-type bowl where the various phases separate. In clarification operations, solids collect at the periphery of the rotating bowl, and are ejected automatically at preset intervals into a sludge chute. In separation operations, the solids follow the same course, but the liquid phases split into separate streams.

All metal parts in contact with the process stream are stainless steel. Powered by a 40-hp. motor, the unit operates at 1,500 to 8,000 gph.—**Centrico Inc., Englewood, N. J. 221A**

(Continued on next page)

new **STRONG**

ductile iron steam traps give you cast steel service at less than half the price!*

Strong's new 540 series Hydro-Flex Steam Traps are made of DUCTILE (NODULAR) Iron that can be bent or twisted without breaking. This newest metallurgical development, adopted by ASME*, enables Strong to produce traps for service up to 500 psi and 650°F with ample safety factor. Ductile Iron economy permits sale of these traps at less than half the price of comparable cast steel traps.

*Ductile (Nodular) Iron meets the requirements of the ASME Code for use in vessels at pressures to 1000 psi and temperatures to 650°F (80% of cast steel service).

1. Safer to use because Ductile Iron body and cover will bend or twist in case of explosion or fire whereas brittle materials might shatter or break.

2. Especially recommended for drainage and drip service on high pressure steam systems and on both high and low pressure systems in chemical plants and refineries where steel is normally required.

3. Wide choice of sizes and capacities: Pipe sizes from ½" to 2", capacities to 42,800 pounds of water per hour.

4. Connections: Traps with screwed connections regularly furnished. (Although Ductile Iron can be welded or brazed under controlled shop conditions, welding is *not* recommended for field fabrication.)

Strong 540 Series Ductile Iron Traps are available from your local Strong Distributor. Call him for more information, or contact . . .

STRONG, CARLISLE & HAMMOND
508 SANDUSKY STREET • CONNEAUT, OHIO
air traps • strainers • reducing valves • vacuum or pumping traps
continuous blowdown valves • separators • engine stops • F and T traps

Industry's big **DEMAND** for small valves keeps growing every day. A few years ago, Hoke's old plant was more than adequate... the product line was limited to a handful of styles. But along came nuclear energy and mass spectrometry and automation. So our lines grew and grew.

HOKE now manufactures:

Bar Stock Valves to handle high pressures

Packless Valves to resist corrosion, hold high vacuum

Metering Valves to throttle down to a trickle

Check Valves to control one-way flow

Toggle Valves to flip on-off quickly

Pressure Regulators to reduce high pressures accurately

Plus many other types, too. And we're not only making more, we're making them faster...with every Hoke Valve leak tested...in our new automated plant.

When you need **QUALITY** small valves, delivered promptly, tell us your requirements. We'll gladly send you our catalog with specific recommendations.

See our Catalog in Sweet's Product Designer's File

Hoke Incorporated,
39 Piermont Rd., Cresskill, N.J.

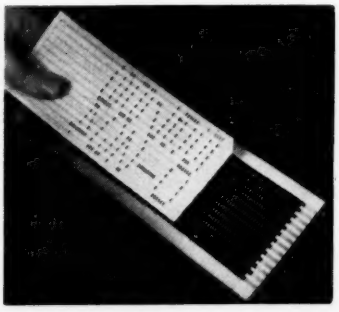
HOKE

Molded Insulation

Two-piece unit covers pipe fittings.

Made of molded glass fibers, new Insul-Sure pipe-fitting insulators offer the user great ease of installation; immunity to rust, rot and corrosion; as well as net cost savings, according to the manufacturer. Simply place the two halves of the insulation over the pipe fitting, and staple, wire or tape the sections together.

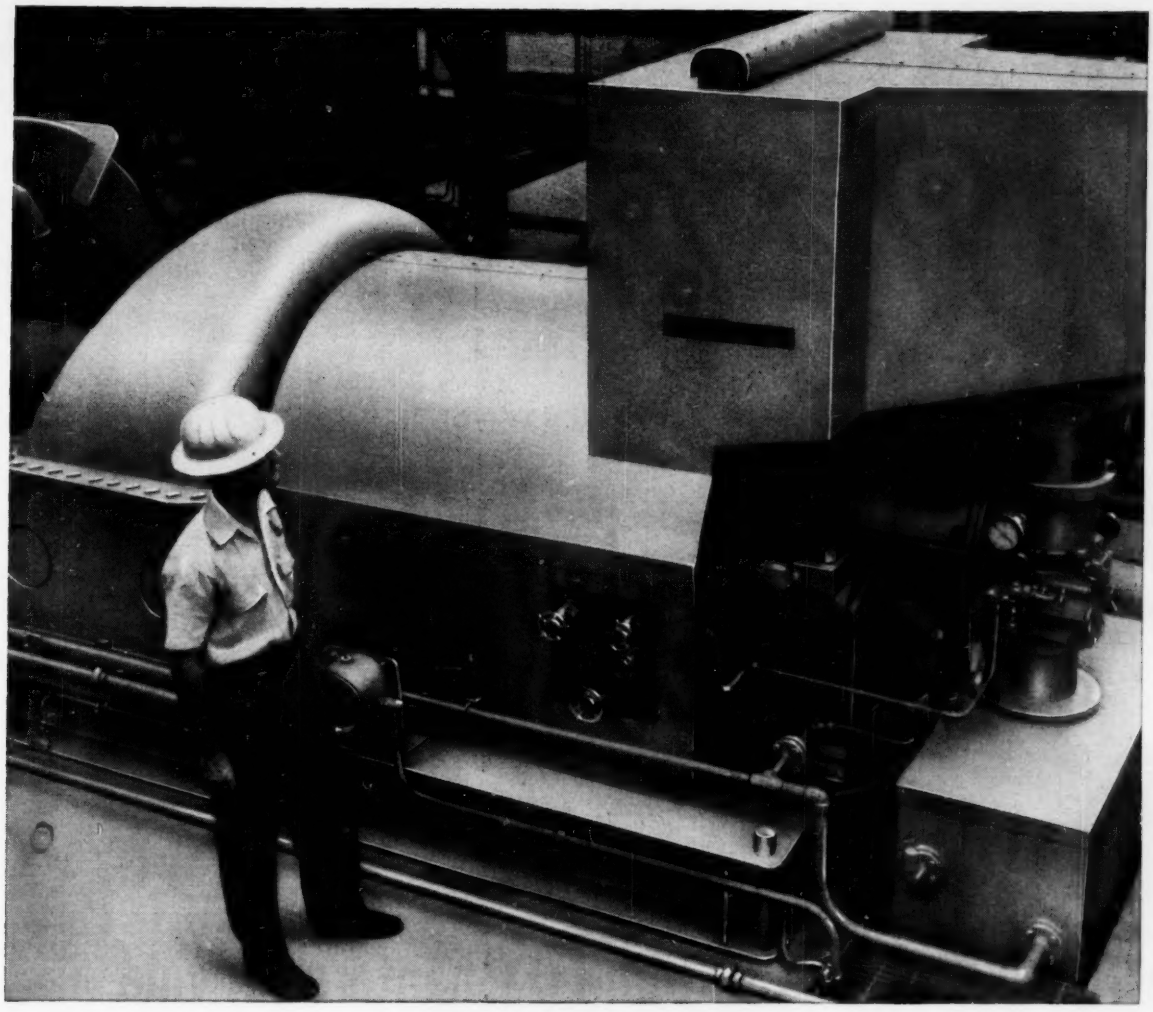
Insul-Sure insulators come in sizes (1-in. thick) 4½ to 8 in. for screwed and welded fittings. A full range of extra-thick insulators is also available. The fittings are not affected by moisture, and are suitable for operating temperatures to 450 F. —**Insul-Coustic Corp., Maspeth, N. Y.** 222A



Photorectifier Plate

Extends flexibility of digital computers.

Computer technology may be profoundly effected by recent introduction to the market of Rex-Array photorectifier plates. Rex-Arrays behave essentially



Westinghouse multi-stage, hi-speed turbines guarantee you

...engineered power to meet your exact needs

Why pay for power you can't use? Or, by the same token, why strain a machine beyond its capability? Westinghouse can meet your exact turbine requirements with the world's broadest line of wheel sizes and design capabilities for steam conditions through 2400 psig—1050° F at the throttle, exhausting from 1 in.hg absolute to 300 psig.*

Fitting the right wheel size to the job is the key to efficiency and economy. By knowing your process requirements, cost of steam and number of hours you expect your turbine to run during the "payoff" period, we can provide the turbine design best suited to your power and economic requirements.

To meet these varied requirements, Westinghouse has available five frame sizes of multi-stage, hi-speed turbines with wheel diameters ranging from 12 in. to 32 in. In addition, interchangeability of many wearing parts saves you money on inventories and stocking of spare parts.

Westinghouse turbine specialists located throughout the country are available at all times to provide personal attention to your heat balance problems, and are equipped to offer on-the-spot price and performance data for this entire turbine line. The capabilities of the world's largest and most modern small turbine facility are at your disposal. Call your Westinghouse representative, or write Westinghouse Electric Corporation, Small Turbine Sales, Lester Branch Post Office, Philadelphia 13, Pennsylvania. J-50605

***WESTINGHOUSE MULTI-STAGE, MULTI-VALVE, HI-SPEED TURBINE FRAME CAPABILITIES**

Turbine Frame	M-12	M-16	M-20	M-25	M-32
Number of Stages			As Required		
Wheel Size, in.	12½	16	20	25	32
Maximum hp	4000	5000	7000	10,000	16,000
Maximum rpm	16,000	12,500	10,000	8000	6000
Maximum P_1, psig	1500	1500	1500	1500	1500
Maximum T_1, °FTT	950	950	950	950	950
Maximum P_2, psig	300	300	300	300	50
Exhaust Size, in.	20	24	30	36	48
D. F. Exh. Size, in.	30	36	48	42 x 64½	48 x 84
Max. Inlet Size, in.	5	6	8	10	12

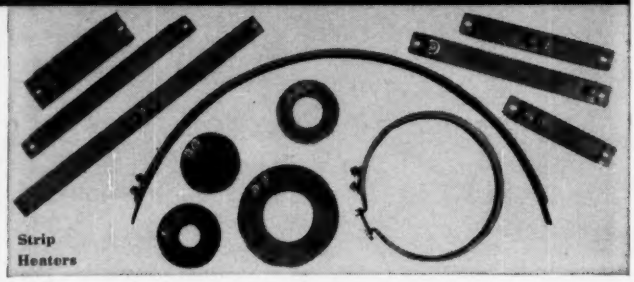
(For special applications, inlet steam conditions to 2400 psig, 1050° F total temperature can be accommodated.)

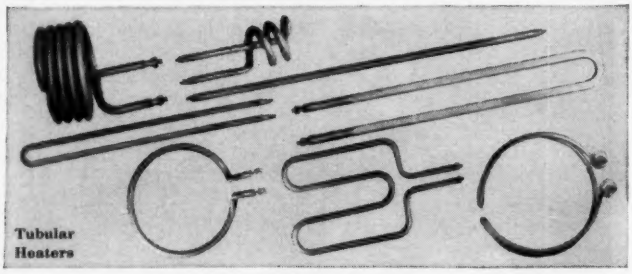
YOU CAN BE SURE...IF IT'S

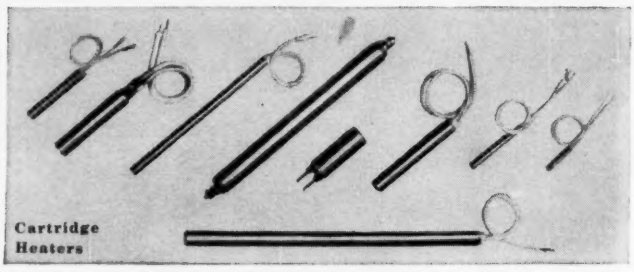
Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS"-CBS TV MONDAYS

Call your CHROMALOX Man for the heating answers







These 3 basic CHROMALOX heaters provide answers to just about any heating problem

Strip Heaters . . . that quickly and easily bolt or clamp to platens, dies, kettles, tanks, pipes, rolls, drums, ovens and air ducts. Lengths from 4 to 96 inches, widths from ¾ to 2½ inches, with cross section curving or lengthwise bending. Available with brazed-on fins.

Tubular Heaters . . . that clamp on, fit into machined grooves, cast into metals, immerse in liquids, install in ovens and ducts. Straight lengths or factory-formed to nearly any contour. Lengths from 6 inches to 30 feet. Triangular or round cross section. Available with brazed-on fins.

Cartridge Heaters . . . that smoothly fit standard drilled holes in dies, platens, molds, extrusion and injection barrels. Special leads available for protection against flexing action, abrasion, moisture or vapors. Diameters from ⅜ to $1\frac{19}{64}$ inches, lengths from $1\frac{5}{8}$ to $25\frac{3}{8}$ inches.

Versatile Chromalox electric heaters are available in sheath materials and wattages to match almost any application to 1100°F. Easy to install, they are fast, clean, safe and economical.

Each has particular advantages. Your Chromalox Man can help you determine the one that best answers your specific problem. He's backed by the world's largest factory stock of industrial heaters, ready for immediate shipment. Why not give him a call. You'll find his phone number listed at the right.

Our new Catalog 60 provides detailed product information and suggests numerous applications for the complete line of Chromalox electric heaters for industry. If you have not yet received a copy, please let us know. 7760

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INDUSTRIAL • COMMERCIAL • RESIDENTIAL
EDWIN L. WIEGAND COMPANY
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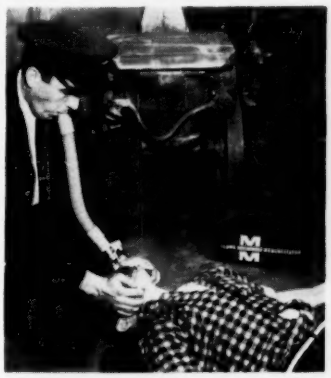
like an array of diodes—with several important differences. Each of the new plates is equivalent to a large conventional diode network, yet requires practically no soldering and only utilizes up to one-twentieth the space. Packing densities of 100 "light cells" per square inch are now being manufactured.

Photorectifiers operate only when illuminated. They can be used in conjunction with any punched-card system, replacing mechanical methods of film reading, card reading and character recognition. Rex-Arrays are applicable to existing digital computers as well as new units.—**The Rex Corp., West Acton, Mass.** 222B



Resuscitator

Helps rescuers to breathe life into accident victim.

A new mouth-to-mask resuscitator enables plant personnel to revive the victim of an asphyxial accident by an extension of the approved mouth-to-mouth technique. The equipment's valve permits passage of air only from rescuer to the victim.

Use of the new resuscitator places the rescuer at the patient's head and sufficiently far away to monitor chest movement and lip color without interruption of breathing rhythm. A rebreathing system prevents hyperventilation and enables continuous use.—**Globe Industries, Inc., Dayton, Ohio.** 225A

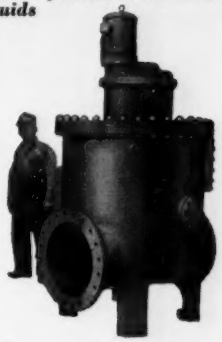
(Continued on next page)

More clean water at a lower cost with

S.P. KINNEY **AUTOMATIC SELF-CLEANING**

STRAINERS

. . . for efficient removal and disposal of suspended particles from raw or process water and other liquids



- Over 1000 installations
- 2" to 48" pipeline sizes
- Installation on pressure or suction side of pump

Write today for Bulletin 500.1C

S.P. KINNEY ENGINEERS, Inc.
CARNEGIE, PENNSYLVANIA

For Immediate Service
PHONE MAIN 6-3712

BLINDS • SPACER RINGS • TEMPORARY and LINE STRAINERS • PIVOT FLANGES

PERFORATED CONICAL TEMPORARY STRAINER

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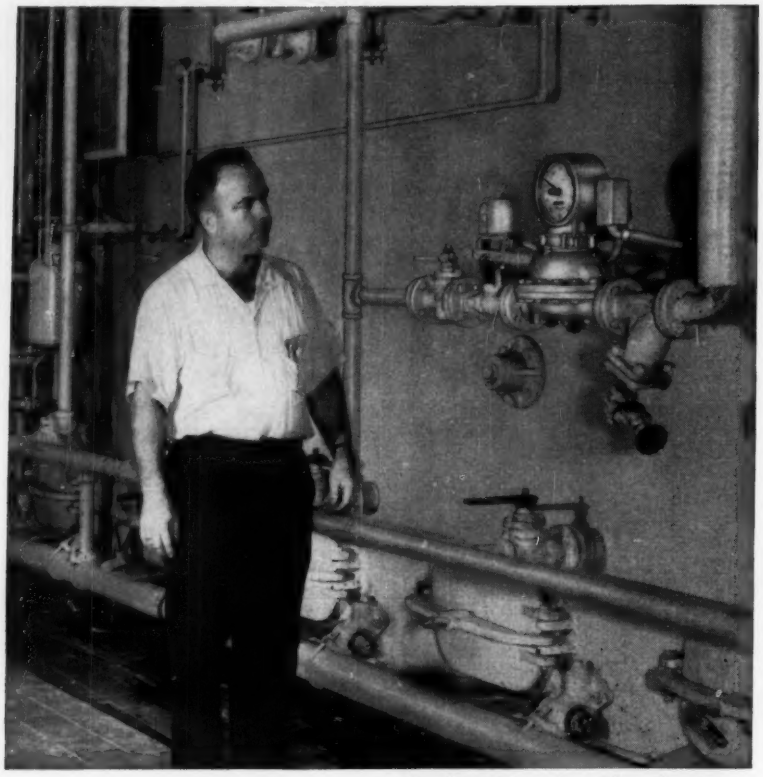
The MACK IRON WORKS COMPANY
132 WARREN STREET
WRITE TODAY FOR CATALOG A-9

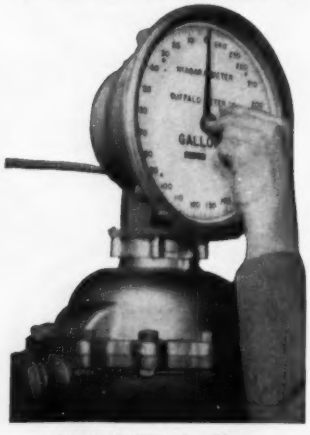
HOW TO METER
Hard to Handle Liquids



Bottle washing plant of large brewery

and do it Automatically

Set for 175 Gallons



Get 175 Gallons

That *was* the problem at a large brewery. The liquid was caustic soda. It had to be measured accurately and added to the water in the bottle-washing machine to remove labels and foreign matter.

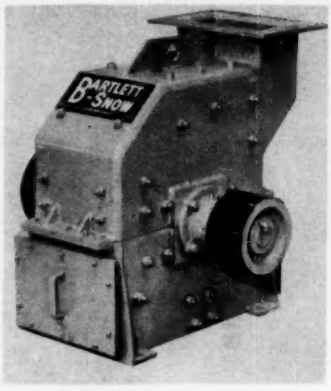
The liquid caustic was stored in two large tanks. By piping the liquid through Niagara Electricontact Meters, it was only necessary for the operator to set the meter dial hand to the desired number of gallons of caustic, then press a push button to start the delivery to the washing machine. Upon delivery of the preset quantity, the switch in the Electricontact Meter closes a solenoid to stop the flow of caustic. Simple . . . accurate . . . and fool-proof!

Let us show you how to solve your liquid metering problem to give you cost-saving, time-saving accuracy by automation. Write for complete information.

BUFFALO METER COMPANY, Incorporated

2891 MAIN STREET • BUFFALO 14, NEW YORK

NEW EQUIPMENT . . .

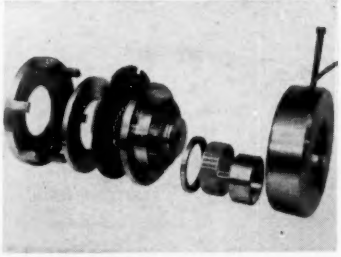


Pulverizer

Swing-hammer unit has low power consumption.

Low power consumption and small size are among the features of the new Cyclo pulverizer, which crushes materials to a 10- to 40-mesh size at rates up to 10 tons/hr. In operation, high-speed rotation of the hammers beats incoming solids against a series of hardened breaker blocks. A bottom screen discharges material reduced to the proper mesh.

Extending the full width of the crusher, the one-piece hammers are made of manganese steel. Breaker blocks, liners, hammers and screens or grates are accessible for easy replacement. Power requirements for the three available sizes range from 5 to 20 hp.—**The C. O. Bartlett & Snow Co., Cleveland, Ohio.** 226A

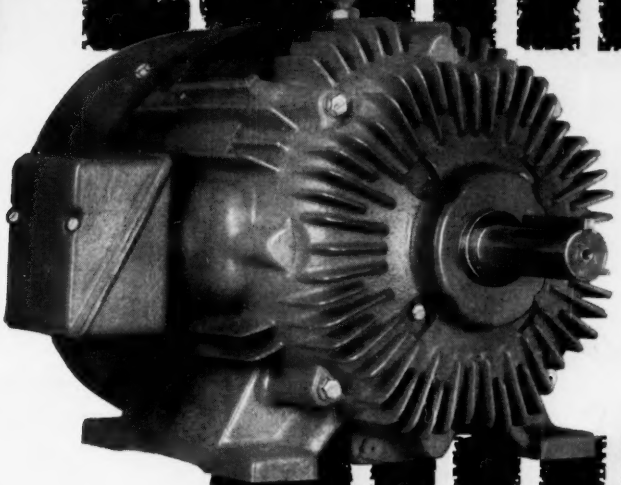


Magnetic Clutch

High-torque unit requires almost no care.

Developed after more than three years of experimentation, new stationary-field magnetic

SPECIALLY BUILT

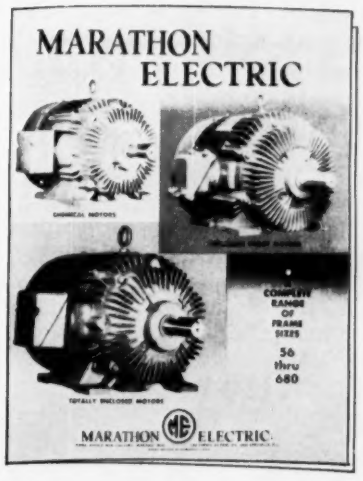


for all atmospheric and hazardous conditions

Depend on *ME* for designs that assure safe, long motor life despite corrosive elements in and about chemical plants. From a complete range of chemical and explosion-proof motors, Marathon quickly supplies your needs from a single motor to power-fitting an entire plant.

Free detailed information.

Marathon chemical motors incorporate the most recent features and improvements based on almost 50 years of motor building. For complete factual information, write for your copy of bulletin SB-185. *Marathon Electric Manufacturing Corporation, Wausau, Wisconsin.*



Motors and generators—that's our business!

Motors from 1/20 HP to 3500 HP
Generators from 1/2 KW to 2500 KW

MARATHON ELECTRIC

Home Office and Factory, Wausau, Wis. • Factories At Erie, Pa. and Earlville, Ill. • Sales Offices in Principal Cities

HIGHEST FLOW RATES

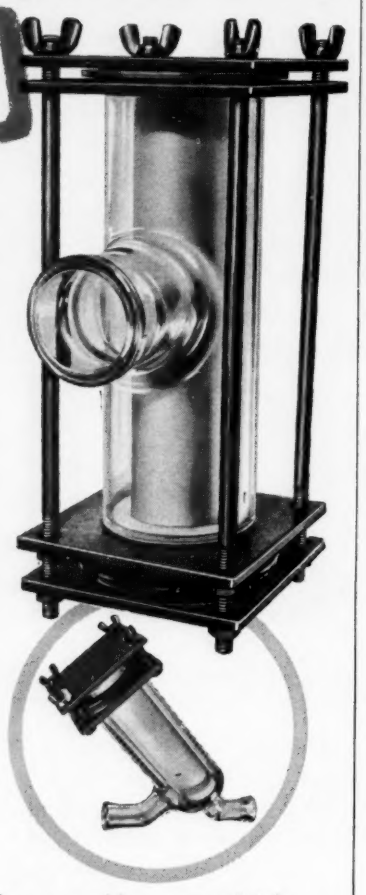
MINIMUM PRESSURE DROP

COMPLETE CHEMICAL RESISTANCE

NEW

Chem Flow

FPT FILTERS



- Constructed of PYREX* Brand tubing and Teflon
- Transparent body
- Permanent filter element
- Compact design
- High heat resistance
- Uniform structure, voids and particle retention
- Complete micron porosity range

FPT Filters are a new type of filter assembly . . . completely resistant to chemical attack and ideally suited for filtration of liquids, gas diffusion and purification. The extremely hard and permanent filter element offers maximum particle retention with very high flow rate. The porosity range covers one to 100 microns. Use Chem Flow FPT Filters for sterilization, clarifiring, polishing applications at pressures up to 50 psi, temperatures as high as 450°F. Available in angle and "Y" types.

For specifications and performance data, write for Bulletin FPT-2.

*Trade Mark, Corning Glass Works

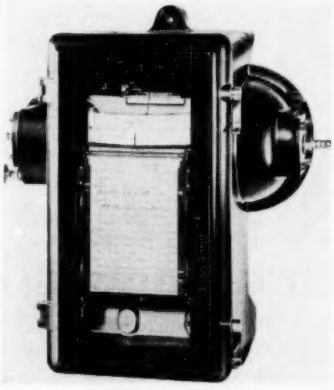
Chem Flow®

CHEM FLOW CORP.

119 Dell Glen Avenue • Lodi, New Jersey

clutches virtually eliminate the need for maintenance in machine transmissions, according to the manufacturer. Once installed in a transmission, the clutches can be forgotten—there are no air-gap adjustments to be made, no slip rings and brushes to be cleaned, adjusted or replaced. The new units are also claimed to provide more torque for their size than any other units commercially available.

Designated EC-S, the clutch series includes five sizes with torque ratings ranging from 14 through 290 lb.-ft. The series will be expanded to include a total of 12 ratings by mid-1959. Available from stock for standard 24- or 90-v. d.c. operation.—**ITE Circuit Breaker Co., Philadelphia, Pa.** **226B**

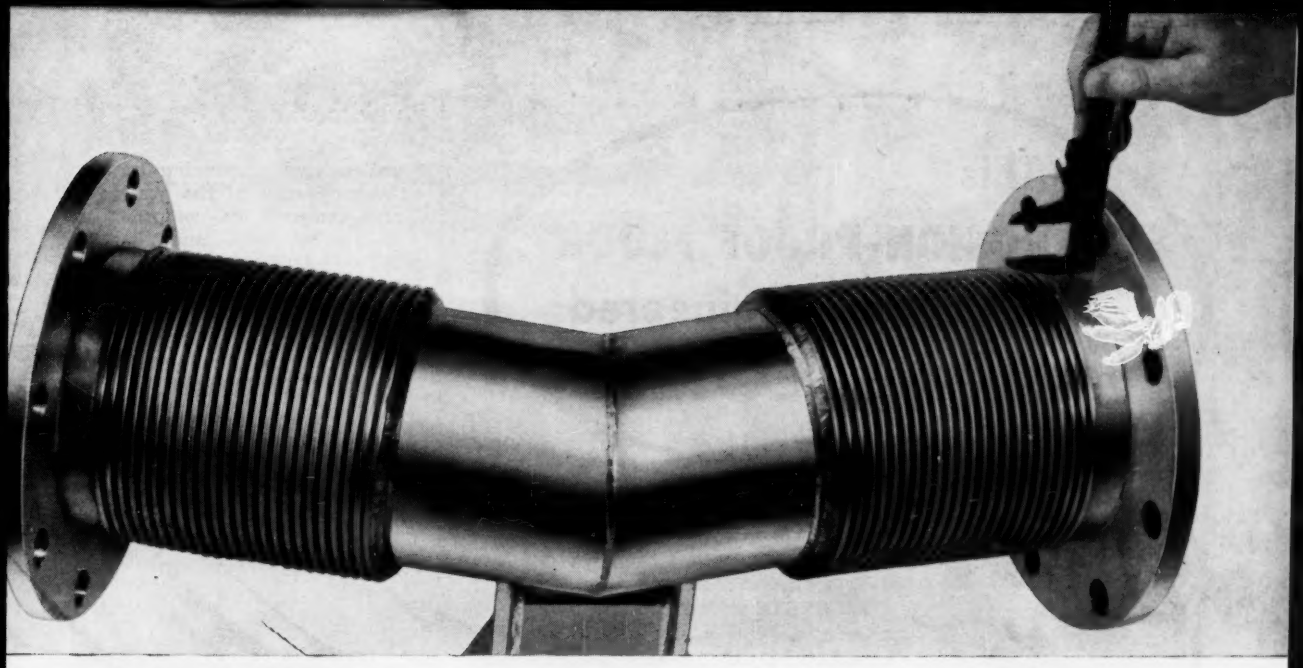


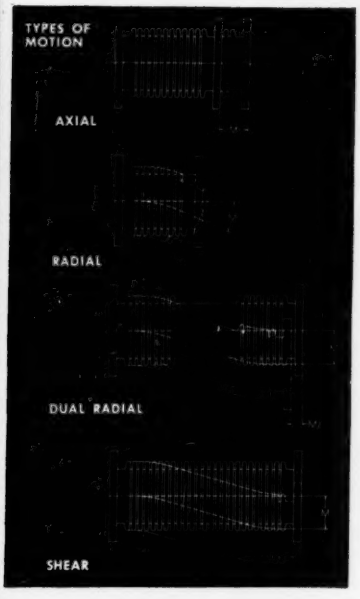
Gas Density Recorder

Provides continuous reading of gas density.

Pollux gas density recorders, which are particularly suitable for installation in hazardous areas, are now available for the first time in the U.S. through Air Conditioning Equipment Corp., sole distributor; the recorders have been in successful use elsewhere in the world for over 20 yr.

Designed to provide continuous accurate records of absolute density, the recorder works on the buoyancy principle—the lifting force of a displacement element, dependent on gas density, is measured. Scale is adaptable to any desired grad-



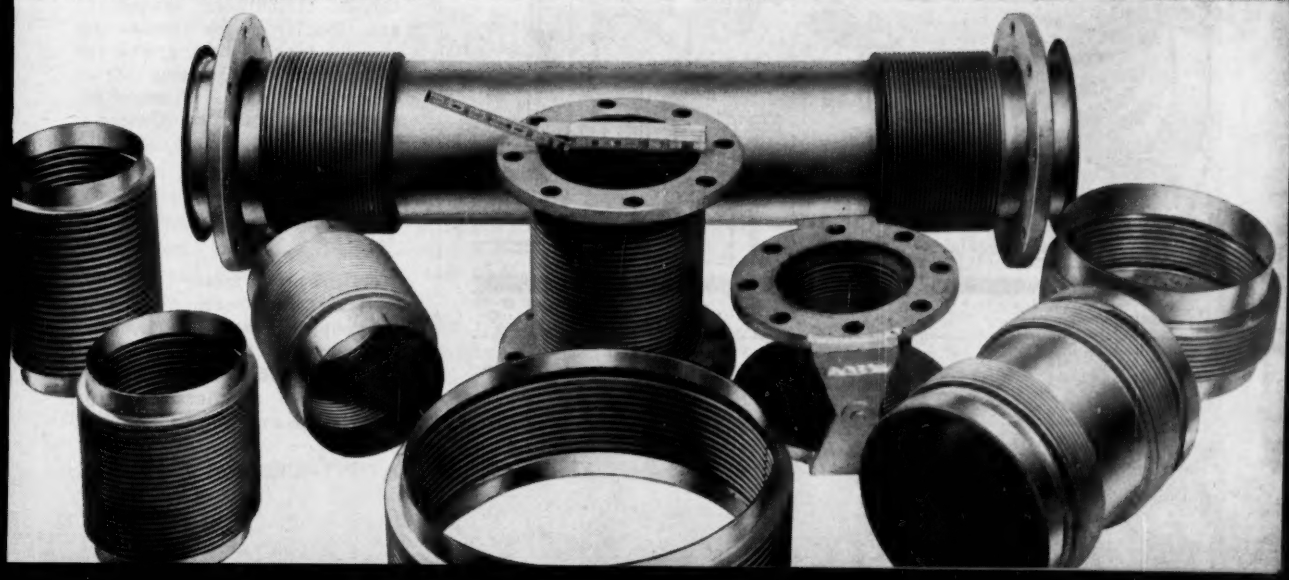


Expansion-joint tubing for big, tough jobs

New AX Tubing by Anaconda is available in Bronze, Stainless Steel, and other metals and alloys—from 4½" I.D. to 14" I.D.—to handle axial and lateral movement.

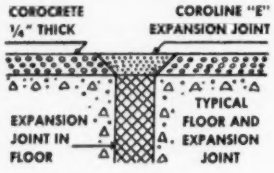
Need to compensate for contraction of piping suddenly cooled to minus 300°F by a large volume of liquefied gas? Want a bulkhead seal that "gives" with hull movement? Do you need a special assembly like that above, which handles an offset and a combination of lateral and axial movement? Wherever you need large diameter tubing to take care of movement shown in drawing at left, or simple offset, write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 59128

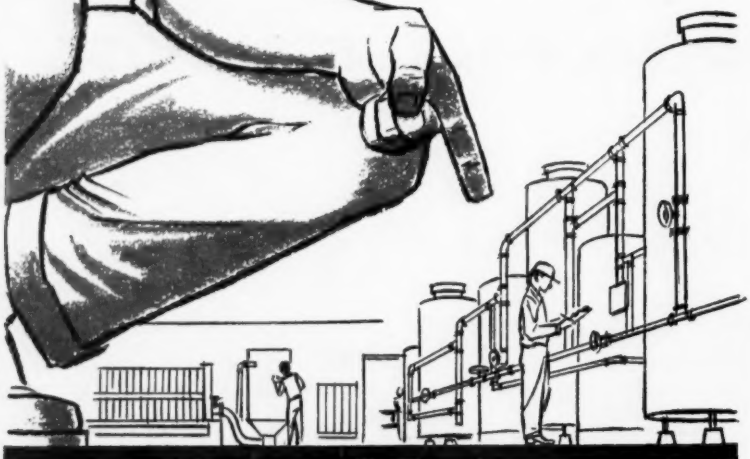
ANACONDA® METAL HOSE



This
CORROSION-PROOF FLOOR
was pre-engineered
by CEILCOTE!

Ceilcote offers 33 years of technical experience in *engineering* floors. Scientifically applied over new or old concrete, COROCRETE monolithic floors are four times stronger than concrete . . . offer maximum resistance to acids and alkalis . . . provide for thermal expansion. Available in finishes ranging from non-skid abrasive to highly polished surfaces, COROCRETE withstands impact and thermal shock without spalling or cracking. COROLINE is used to cover expansion joints or combined with glass cloth reinforcing to line trenches and pump bases. Write today for complete information on materials and installation services.





CORROCRETE CEILCOTE

THE CEILCOTE COMPANY, INC.
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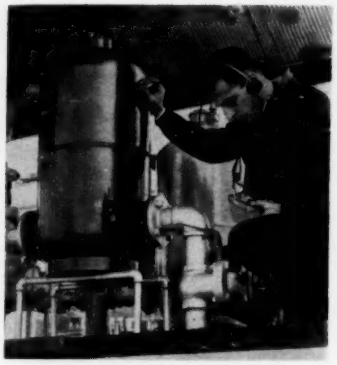
8864-CC

uation and measuring range. Average error of the pressure- and temperature-compensated instrument will not exceed ±1%.—**Air Conditioning Equipment Corp., N. Y.** 228A



Thickness Tester

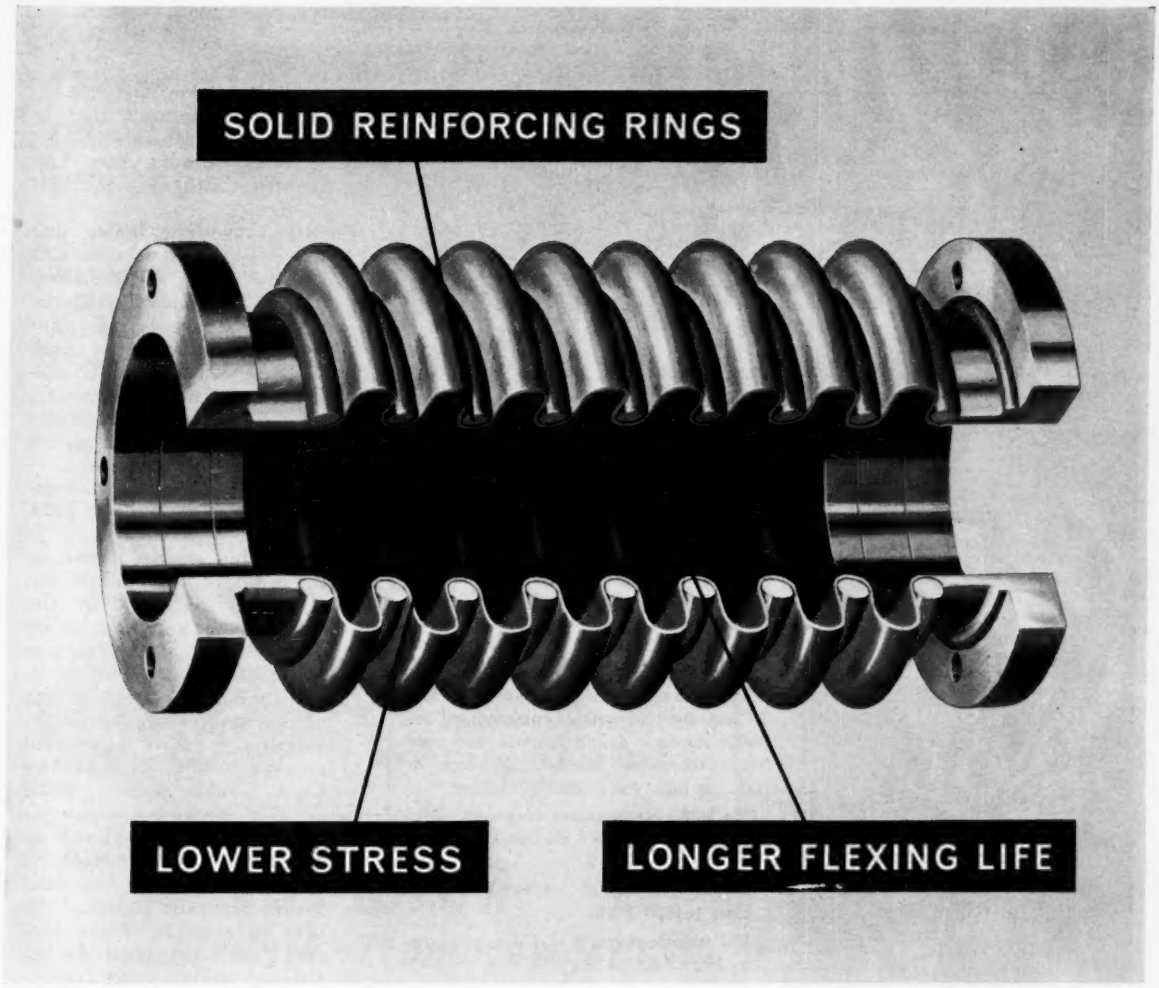
Instrument for nondestructive inspection.

Weighing less than 5 lb.—including batteries, probe, harness, cable and earphones—the new Audigage Model 6 nondestructively measures the thickness of most metals, glass, ceramics and plastics. The instrument, an ultrasonic resonance gage, is claimed to be ideal for field inspection of piping and process vessels when corrosion is suspected.

Instrument range is 0.09 to 5.0 in.; accuracy falls within 3 to 5%. Audigage may be used on any flat, cylindrical or compound-curved surface, down to a 1-in. radius, using the standard transducer provided. Different transducer mountings are available for measuring smaller pipe or tubing, and for measuring thicknesses from concave surfaces.—**Branson Instruments, Stamford, Conn.** 230A

BRIEFS

Vertical pump motor for industrial short-coupled turbine pumps is available in sizes from 6½ to 125 hp. on frames 254 to 445. The new drive combines an electric motor, high base and adjustable cou-



NEW SOLA-FLEX® JOINT!

Unique solid-ring-supported joint withstands pressures to 1200 psi

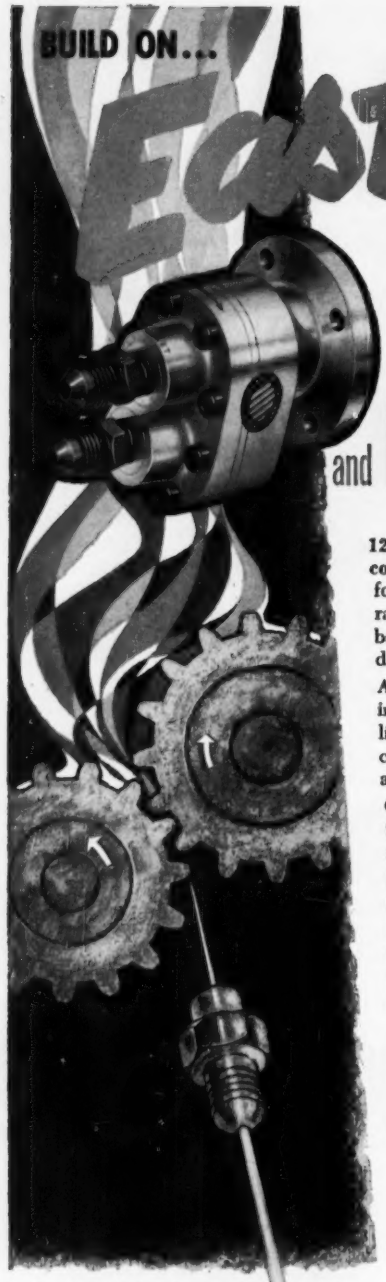
SOLAR'S NEW RING-SUPPORTED expansion joints offer advantages found in no other design. Reinforcing rings are a solid bar formed integrally with the bellows element—allowing 100% weld penetration of the cross section area. Precise forming and sizing of rings eliminate pre-operating radial clearance commonly found in other types. Result: higher working pressures, lower stress, longer flexing life with new ring-supported Sola-Flex expansion joints.

Solar manufactures the most comprehensive line of expansion joints in the world. They are made from a wide variety of stainless and high alloys for important nuclear, missile and industrial applications—in sizes ranging from ½ in. to 35 ft in diameter. They are built for service from −320F to 1200F. And they tame "hard-to-handle" pressures up to 3500 psi for special applications. Delivery is fast.

A new pamphlet describes Solar's complete line of expansion joints. Write for it to Dept. G-116, Solar Aircraft Company, San Diego 12, California.

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

ENGINEERS WANTED! *Challenging projects, unlimited opportunities with Solar. Write today!*



BUILD ON...

Eastern

HYDRAULIC EXPERIENCE:

GEAR PUMPS and FLUID MOTORS

129 hydraulic pump and electric motor combinations are available off-the-shelf, for most applications. Outside this broad range, specific customer requirements can be met by drawing on Eastern's vast design resources.

All standard Eastern gear pumps are low in cost, light in weight, compact and reliable. Unique design features and very close tolerances enable each unit to achieve high volumetric efficiencies.

Check the performance ranges in these three major groups – do they meet your needs?

1200 series – up to 1.6 G.P.M. – pressures to 800 P.S.I.

100 series – up to 5 G.P.M. – pressures to 1500 P.S.I.

700 series – up to 9.8 G.P.M. – pressures to 1500 P.S.I.

In addition to these pumps, Eastern also produces a wide range of fluid motors, each capable of delivering a constant torque over a very wide speed range. They provide up to 14.5 ft. lbs. of torque at 1750 R.P.M. For full information on any one of these pumps, pump-and-motor combinations, or fluid motors, consult the Eastern sales engineer – or write for bulletin 810-P.

Eastern designs and builds

positive displacement pumps • gear pumps • centrifugal pumps

EASTERN INDUSTRIES INCORPORATED
100 SKIFF STREET
HAMDEN 14, CONN.

EASTERN INDUSTRIES PUMP DIVISION

pling into one unit that is designated Unibase. — **U. S. Electrical Motors, Inc., Los Angeles, Calif.** 230B

Packaged fire-tube boiler line includes three new units, 400, 500 and 600 hp. in size. Each of the new units features four-pass, forced-draft construction that assures high flue-gas velocity, 80% efficiency and less tube cleaning. A unified electric and steam oil preheater reduces piping and radiant heat loss. — **Cleaver-Brooks Co., Milwaukee, Wis.** 232A

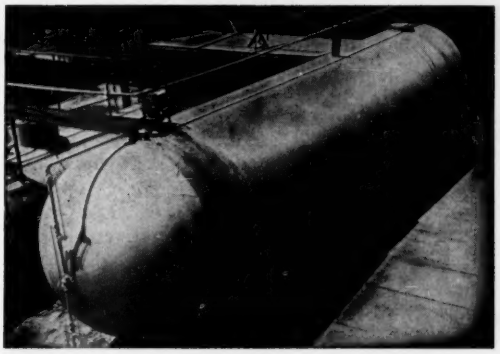
Gas-handling system known as Liqua-Guard reduces cost and increases efficiency in the storage and handling of atmospheric gases, according to the manufacturer. The system includes a complete line of vacuum-jacketed vessels, vaporizers and associated equipment. — **Cambridge Corp., Lowell, Mass.** 232B

Automatic air filter known as the Type H Roll-O-Matic is claimed to answer the need for horizontally designed filters in systems where limited headroom is a factor. Offered in ten sizes for capacities up to 39,000 cfm., the new unit requires an absolute minimum of maintenance; filter resistance is constant. —**American Air Filter Co., Louisville, Ky.** 232C

Starter line, size 0 to 4, features unitized construction, making possible the benefit of build-block modification for economical versatility. Standard, special-design and accessory control devices are available for applications from 110 to 600 v. for fractional to 200-hp. motors. — **Allis-Chalmers Mfg., Milwaukee, Wis.** 232D

Glassed ductile iron fittings that are 2½ to 3 times stronger than conventional glassed gray iron fittings will be made available on July 1. Thermal shock resistance is markedly increased, according to the manufacturer. Line will include 45- and 90-deg. ells, tees and crosses in 1½-, 2-, 3-,

TANKS for CHEMICAL STORAGE



Backed by 103 Years of Fabrication Experience

• We have been supplying the chemical processing industry with tanks and vessels for chemical storage for three generations. In addition to carbon and stainless steel, we also fabricate and erect tanks, pressure vessels and processing equipment of aluminum and special alloys. . . . Investigate our facilities and take advantage of our 103 years of specialized knowledge and experience. . . . Write for *Tank Talks.*

R. D. COLE MANUFACTURING CO. COLE NEWNAN, GEORGIA

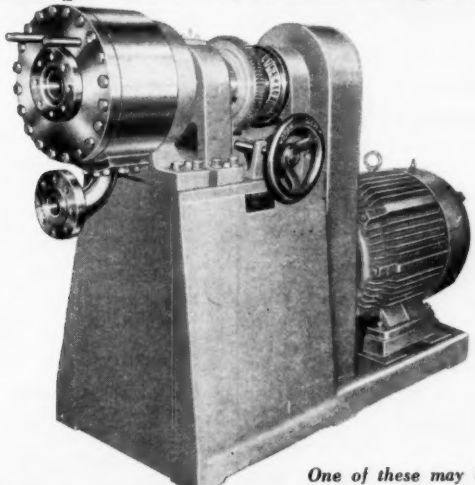
Elevated Tanks, Pressure Vessels, Chemical and Processing Equipment from Aluminum, Stainless and Carbon Steel, Monel and Other Alloys.

Established 1854

R. D. COLE MANUFACTURING CO.
NEWNAN, GEORGIA

TRI-HOMO
Disperser-Homogenizer

for particle size reduction of slurries proven for performance, results & dependability



One of these may be your answer.

Illus. size # 10—40 hp. designed for 1000 p.s.i. continuous production at 450° F. 47 alternate models from 1 hp to 150 hp for development or production quantities

TRI-HOMO CORPORATION
HIGHLAND AVE., At Colby · SALEM, MASSACHUSETTS

ADAMS CATALOG FILE

These Bulletins will help you solve your compressed air and liquid filtration problems.

For more than twenty years, the R. P. Adams Co. has worked with engineers to improve compressed air and simplify liquid filtration. The following literature reflects this wide experience — why not take advantage of this know how — write for your copies today?

Air and Gas Aftercoolers and Cyclone Separators

. . . provide effective low cost moisture removal from compressed air and gasses. Wet compressed gasses must be freed of damaging moisture before they can be safely used in air operated tools, equipment and instruments or other applications. The counterflow, water-in-the-shell design affords highly efficient vapor condensation. Models are available for cooling the gas to within 10° or 2° of the cooling water — dependent upon the dryness required. The Cyclone Separator then effectively removes condensates over a wide range of flows. This combination assures you of moisture free — trouble free compressed air and gas with less than ½ P.S.I. pressure loss. Models are available from 60 - 44,000 CFM in working pressures up to 1000 P.S.I.

Write for ..... Bulletin 713

Poro-Stone Air Filters

. . . can eliminate tool malfunction, instrument failure and contaminated products caused by foreign material in compressed air or gasses. Centrifugal separation and efficient Poro-Stone filtration combine to remove all pipe scale, dirt, and entrained oil and water with less than ½ P.S.I. pressure loss — ranges from ⅜" to 4" pipe size, from 15-700 CFM. Models in 150, 300 and 500 P.S.I. Get the complete facts on how to protect your compressed air system and related equipment.

Ask for ..... Bulletin 117

Adams Chemical Filters

. . . provide an effective method of solids removal. Completely enclosed construction coupled with dynamic back wash design provides contamination free — low cost separation. The availability of a variety of filter media meets the needs of any process. A wide selection of materials of construction—including lead and rubber linings—models in jacketed construction—can be supplied in various sizes and capacities. Investigate the many benefits of the Adams Chemical Filters.

Write for ..... Bulletin 431

Adams Industrial Filters

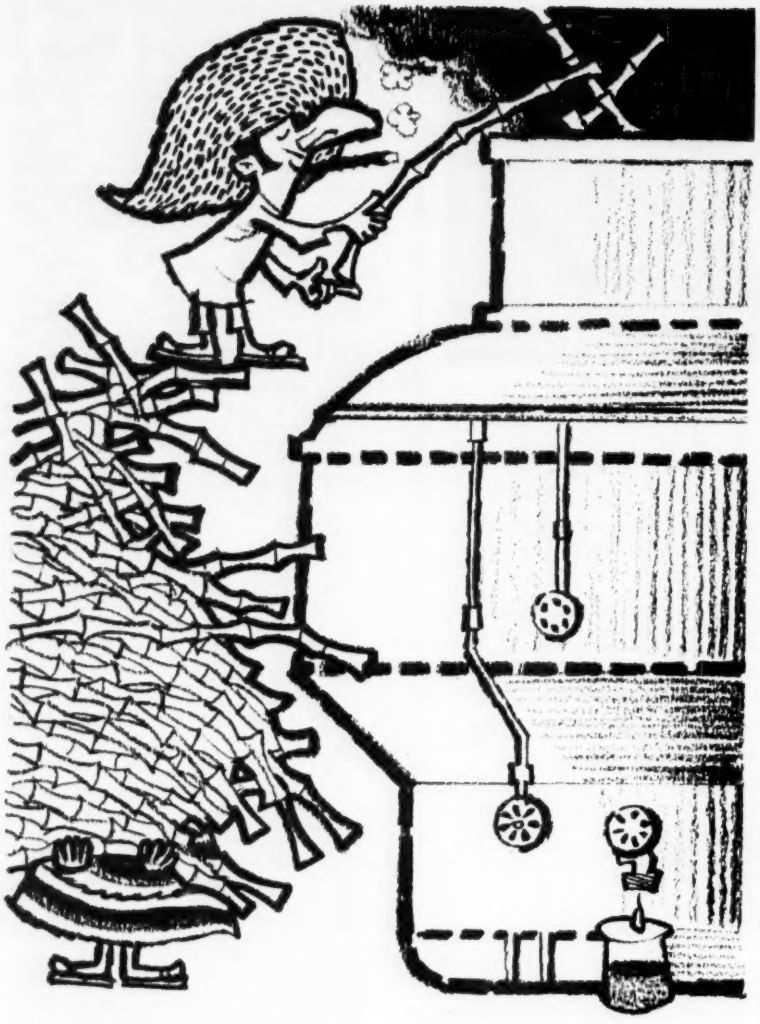
. . . are ideal for the filtration of process liquid and gasses as well as polishing industrial water and waste. An assortment of filter elements to provide efficient filtration for virtually every industrial application are available. Sizes are made to suit any process requirement. For complete details of how Adams filters can reduce your processing costs, write for ..... Bulletin 651

Where automatic water filtration is required, request ..... Bulletin 909

R & D — Pilot Plant Filters

. . . are available as self contained filter packages—including pre-coat equipment. The JWF-28, completely assembled and mounted on a skid, is available for pilot, research and development or for small process applications involving flows up to 80 GPM. You make only three connections. For complete information, write for ..... Bulletin 610

R. P. Adams Co., Inc., 207 East Park Drive, Buffalo 17, New York.



The man who knows his process equipment . . . chooses G-B Evaporators!

Jose' could be taught a few things about the fine art of cane syrup evaporation . . . but not the man who regularly specifies G-B Evaporators.

Men who know their process equipment in the aluminum, paper, sugar and other chemical fields have been specifying G-B evaporators since 1879.

We are loaded with facts, figures and case histories of experts who have chosen G-B equipment. Just whisper and we'll send them to you.

GOSLIN-BIRMINGHAM
MANUFACTURING CO., INC.
P.O. BOX 631 · BIRMINGHAM, ALABAMA

4- and 6-in. sizes.—**Pfaudler Co., Rochester, N. Y.** 232E

Distribution transformer (dry-type) for 500-kva., three-phase service has been added to the manufacturer's line. Weight and size of the new DT-3 unit is 50% less than previous designs of similar rating. Sound levels, also, are substantially lower. — **Westinghouse Electric Corp., Pittsburgh, Pa.** 234A

Tubing insulation stops condensation on cold lines and provides excellent thermal insulation for copper tubing carrying hot or cold liquids and gases. The cellular, nitrogen-filled insulation has a thermal conductivity of 0.28 at 75 F. Range of sizes is $\frac{3}{8}$ to $\frac{1}{2}$ in.—**Insul-Coustic Corp., Maspeth, N. Y.** 234B

Air-powered Impactool, Size 834, gives 25% more power and runs down nuts and bolts five times faster than earlier models. Designed for $1\frac{1}{4}$-in. bolt size, the new tool operates at 3,500 rpm., and delivers 850 impacts/min. — **Ingersoll-Rand Co., New York. N. Y.** 234C

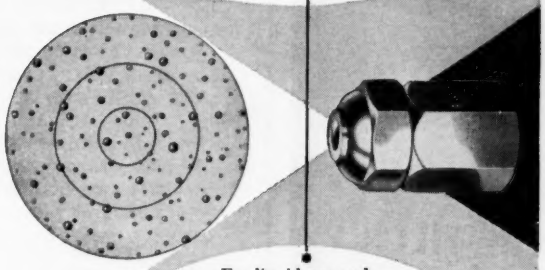
Equipment Cost Indexes . . .

	Sept. 1958	Dec. 1958
Industry		
Avg. of all	230.9	231.3
Process Industries		
Cement mfg.	223.3	223.7
Chemical	232.3	232.7
Clay products	217.0	217.4
Glass mfg.	219.3	219.7
Paint mfg.	222.8	223.1
Paper mfg.	223.8	224.2
Petroleum ind.	227.5	227.8
Rubber ind.	230.3	230.6
Process ind. avg.	228.6	228.8
Related Industries		
Elec power equip.	236.0	236.4
Mining, milling	233.7	234.1
Refrigerating	260.3	260.6
Steam power	218.1	218.4

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124–6 for method of obtaining index numbers; Feb. 23, 1959, pp. 149–50 for annual averages since 1913.

SPRAY NOZZLES

to control LIQUID PARTICLE SIZE and FIELD DISTRIBUTION with ACCURACY



For liquid-gas and liquid-solid contact operations to accomplish physical mixing, chemical reactions or heat transfer, Spraying Systems spray nozzles are available to give you any liquid particle size and spray field distribution you may require. Standard spray nozzles are offered in an unusually wide range of types and capacities . . . special designs are gladly supplied when needed.

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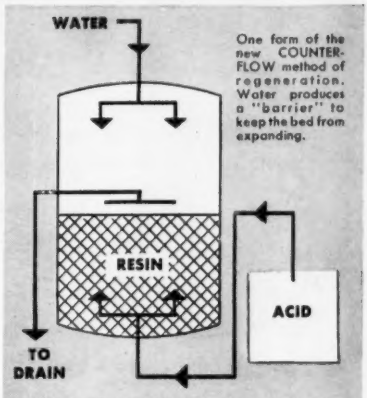
For complete information we invite your inquiry for Catalog 24

ILLCO-WAY ionXchange

COUNTERFLOW*

REGENERATION OF ION-EXCHANGERS



One form of the new COUNTERFLOW method of regeneration. Water produces a "barrier" to keep the bed from expanding.

* "COUNTERFLOW" is the trade mark of Illinois Water Treatment Company equipment utilizing a distinctly new principle of regeneration. Pat. pending.

"COUNTERFLOW" is a method whereby upward regeneration, which has long been recognized as most desirable, is successfully accomplished by establishing a "barrier" at the resin face.

LOOK AT THESE

RESULTS!

- De-ionizer in a power plant. Conductivity of effluent improved from 10 micromhos to 4 micromhos after conversion to COUNTERFLOW. Cation leakage, expected at 4 ppm with downflow regeneration, actually is only 1 ppm.
- Chemical company in Middle West, 480 ppm TDS in raw water. Expected cation leakage with conventional regeneration, 9 ppm; with COUNTERFLOW, only 1.2 ppm.
- Distillery in Middle West. TDS in raw water, 575 ppm. Expected cation leakage with conventional equipment, 6 ppm; with COUNTERFLOW, is actually only 1.5 ppm.
- Western power plant, converted to COUNTERFLOW. Savings in acid reduction, $16,000.00 per year. TDS in raw water, 342 ppm. Predicted cation leakage from curves for conventional design equipment, 4 ppm; with COUNTERFLOW, actually only 1.6 ppm.

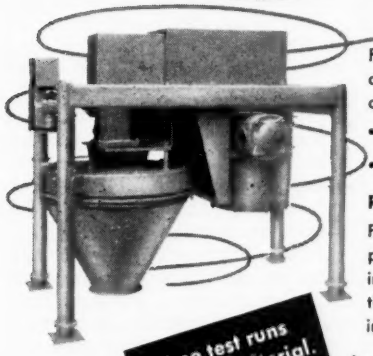
ILLCO-WAY

ILLINOIS WATER TREATMENT CO.
840 Cedar St.
Rockford, Ill.

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

MIX BETTER BY

IMPACT



Finer and more intimate dispersion of solids can be achieved using an Entoleter® centrifugal impact mill.

- Low cost — low power requirements
- Minimum (controlled) temperature rise

RECENT APPLICATION

For the final dispersion of detergent, bleach, perfume and highly abrasive silica flour in a popular powdered household detergent, this 27" model with abrasion resistant impactors does the job.

Free test runs on your material.

Send for literature on Impact Milling, Particle Size Reduction and the new line of Vibrating Screens.

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DIVISION OF SAFETY INDUSTRIES, INC.
P. O. Box 904, New Haven, Conn.

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTERS

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
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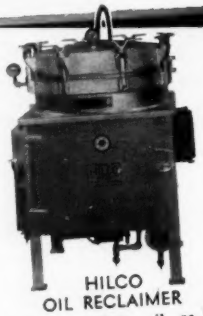

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TECHNICAL

A Good Beginning

ADVANCES IN PETROLEUM CHEMISTRY AND REFINING, Vols. 1 and 2. Edited by Kenneth A. Kobe and John J. McKetta, Jr. Interscience Publishers, Inc., New York. 641 and 634 pages. $13.50 and $14.50.

Here are the first two of a series of volumes that many engineers associated with the petroleum or petrochemical industries will want to have in their libraries. These books, with their sections on Economics and Trends, Unit Operations and Design, Refining Processes, Petrochemicals and Mechanical Equipment, are designed to bring engineers up to date in all these areas. Volume two, just out, by and large reinforces the favorable impression made by volume one.

The editors conceived "Advances" as an annual collection of progress reports by leading authorities on particular subjects. Thus, in a few years the volumes will have touched on all parts of a highly diversified industry and will assume the character of a comprehensive reference. It is certainly rewarding to find between two covers so much recent material on, for example, separation and purification by crystallization (Vol. 1).

One especially strong point of the books is the extensive development of engineering background which effects a happy marriage of theory and practice. In volume one, for instance, the excellent chapter on Superfractionation, Azeotropic and Extractive Distillation (60 pp.) is followed by an equally good chapter on New Fractionating-Tray Design (55 pp.). Volume one's chapter on Alkylation of Paraffins is followed up, in volume two, by Sulfuric Acid Alkylation of Paraffins. And there is very little repetition; the latter chapter concerns only practical applications.

Outstanding chapters in volume one are Catalytic Reforming, The Oxo Process and Solid

BOOKSHELF

J. B. BACON

Polymers from Surface Catalysts. This last includes an excellent discussion of stereospecific polymers and references to much of the work of Natta and Ziegler.

Most interesting chapters of volume two are Raw Materials for the Petrochemical Industry, Radiation Techniques (chiefly techniques in using radioisotopes), Radiation Processing, Coking Petroleum Residues and Commercial Production of Hydrazine. This last chapter is extremely interesting since it is an actual case history of chemical development from the lab work through economics of large-scale commercial production.

There is only one thing that mars the otherwise excellent presentation in these two volumes; and that is that the chapters in volume two on Radiation Techniques and Pebble Heaters could have been improved by tighter editing.—JBB

BRIEFLY NOTED

SELECTED BIBLIOGRAPHY ON BUILDING CONSTRUCTION AND MAINTENANCE. *30 pp. By Edith R. Meggers. Superintendent of Documents, Government Printing Office, Washington 25, D. C.* 30¢. Includes both free and sale publications available from government, trade associations and universities.

MORE NEW BOOKS

STATISTICAL QUALITY CONTROL: AN INTRODUCTION FOR MANAGEMENT. By D. H. W. Allan. Reinhold. $3.50.

FINE PARTICLE MEASUREMENT—SIZE, SURFACE, AND PORE VOLUME. By Clyde Orr, Jr. and J. M. DallaValle. Macmillan. $10.50.

NUCLEAR MAGNETIC RESONANCE—APPLICATIONS TO ORGANIC CHEMISTRY. By John D. Roberts. McGraw-Hill. $6.

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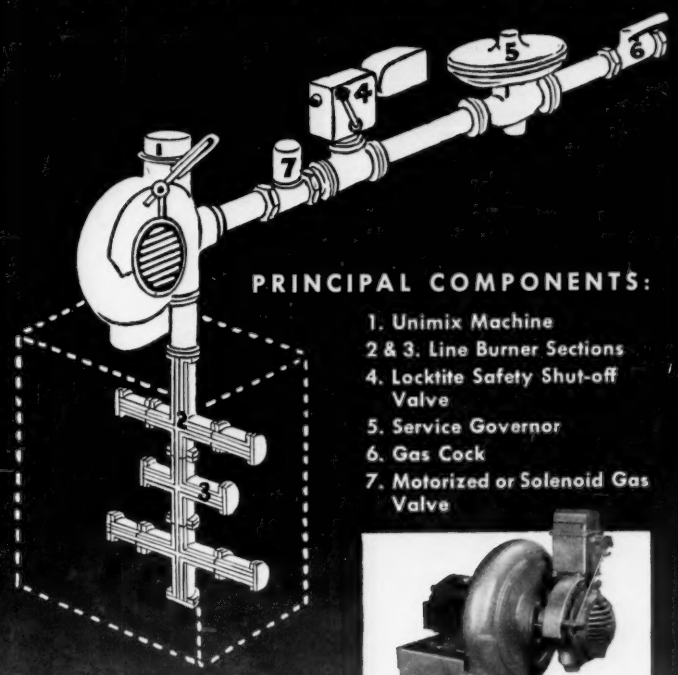

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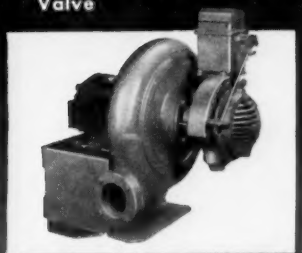

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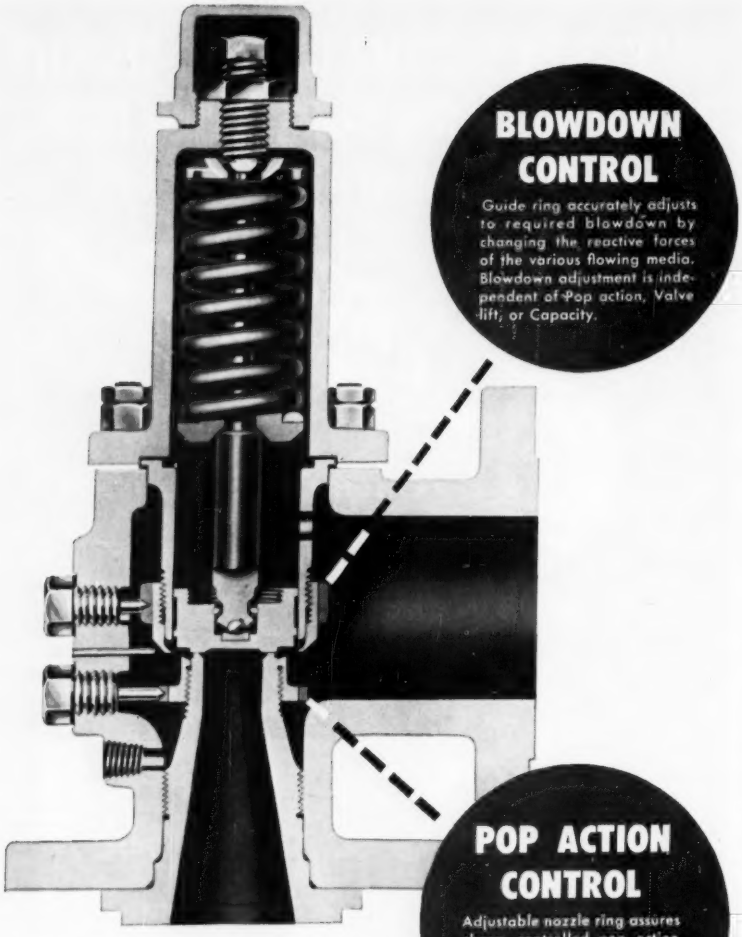
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LETTERS:

We Pass the Buck

Sir:

It was with interest that I read your articles pertaining to urea processes in your January 26 issue. They are worthy of the highest praise.

I respectfully wish to point out what must have been a typographical error in the formula for biuret. You have one too many hydrogen atoms. Correct formula is $NH_2CONHCONH_2 \cdot H_2O$.

G. E. NEVILLE
Charleston, W. Va.

▶ *Mr. Neville is right. This error is a prime example of one of the hazards of the publishing business. We got the incorrect formula out of a well-known chemistry handbook. The typo is theirs, not ours, but we both share the embarrassment.*—ED.

More Logs on the Fire

Sir:

In editing my article, "Estimate Petrochemical Properties" (Feb. 23, pp. 147-148), you erred in the simplification of two of the equations. In Eq. (4), the first term on the right should read "log 2.451" (or 0.38934); similarly, in Eq. (6), the term should be "log 19.078" (or just 1.28053).

Also note that Santa Ana College is not located at Fullerton, Calif.

R. NOKAY
Santa Ana College
Santa Ana, Calif.

Heavy Water vs. Graphite

Sir:

In your March 9 issue, page 69, you said: "A nuclear reactor will work on natural or slightly enriched uranium fuel only if heavy water is used as moderator. Use of light water, or some other moderator, requires a higher proportion of U-235."

This statement is not really

PRO & CON

C. H. CHILTON

true. A nuclear reactor will work, for example, on natural uranium with a graphite moderator.

Granted, a natural uranium-graphite reactor is in a disadvantageous position relative to types using enriched uranium or heavy water with respect to such factors as investment, varieties of coolant, cladding and fuel forms it can use. However, it doesn't seem fair to imply that the former won't work.

HAROLD F. REICHARD
Livingston, N. J.

Cost Data Updated

Sir:

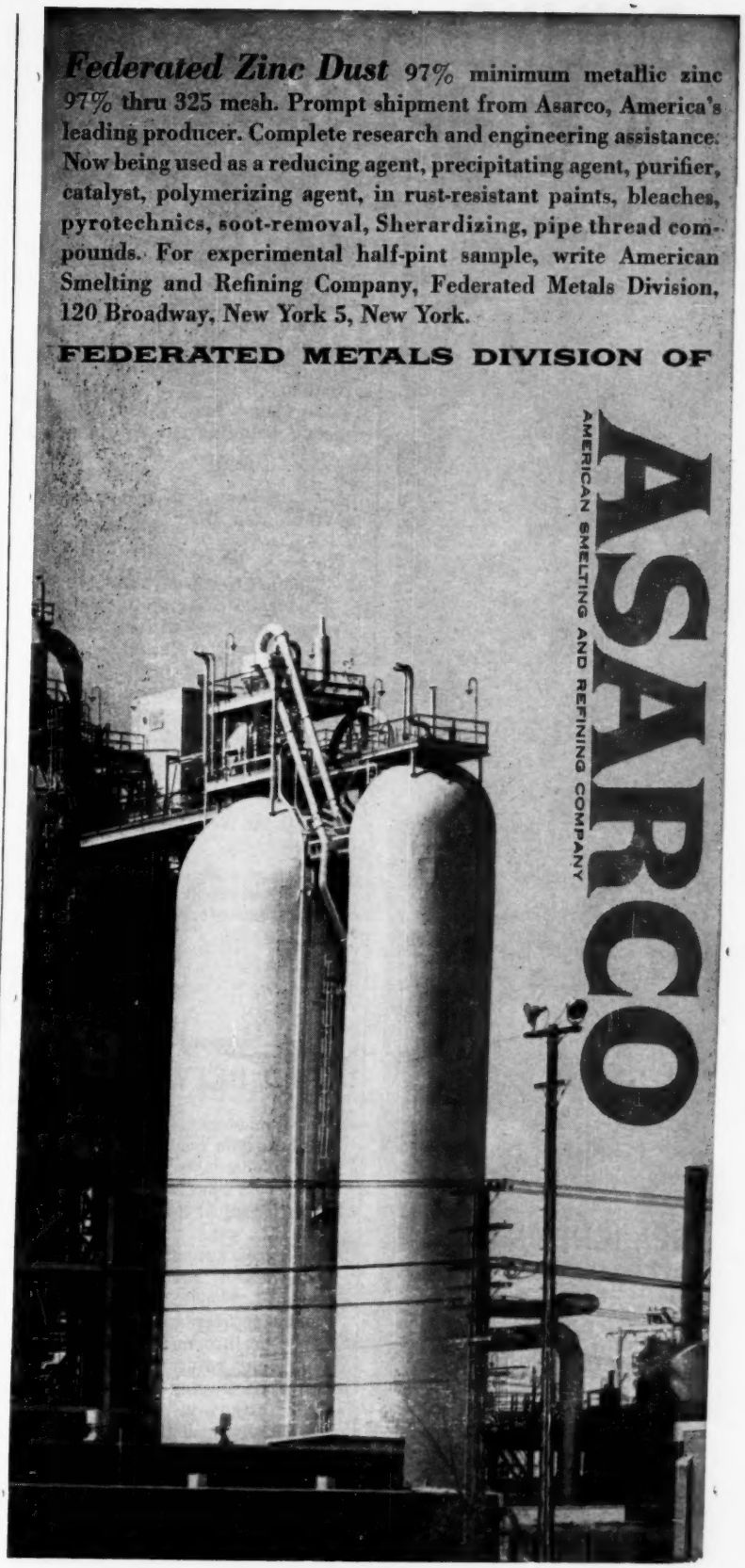
We have one well-worn copy in our department of C. H. Chilton's article, "Cost Data Correlated," which you published in June 1949. This article has proved very useful in preparing preliminary cost estimates of plants for new processes. We have been correcting the 1949 data based on current *ENR* index values.

I would like very much to obtain two additional copies of this article if reprints are still available. Would you also please let me know if these cost data have been revised or whether you are planning any revision in the near future.

ARMANDO CERVI, JR.
Rohm & Haas Co.
Philadelphia, Pa.

▶ *Our supply of reprints of the June 1949 article has been exhausted. We have held up ordering more because we are hoping to put out a comprehensive reprint collection of all our cost articles published during the past ten years. This collection should be available later this year; watch for an announcement.*

The data of this particular article have never been revised as such; they have, in some cases, been superseded by publication of more recent data in other articles. However, we believe that the original data can still be used with a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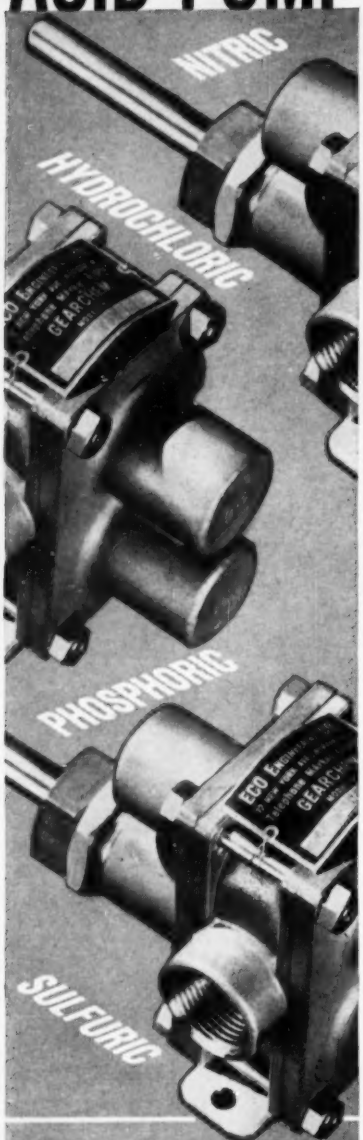

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fair degree of confidence by applying correction factors based on ENR or Marshall & Stevens indexes.—ED.

Con: Two-Color Charts

Sir:

It appears that the chart accompanying the article, "Physical Properties of Water," in your April 6 issue (pp. 139-140) has a slight error. For the value of μ the graduations are not quite regular.

No doubt you will have many people bringing this to your attention.

F. C. MITCHELL
E. I. du Pont de Nemours & Co.
Wilmington, Del.

Sir:

The article by Mr. Gambill on "Physical Properties of Water" is very good except for the print job. The color plate and the black plate are out of register. This makes it extremely difficult to read the curves.

You should reprint this set of curves in another issue in all black.

R. H. HEDRICK
Struthers Wells Corp.
Warren, Pa.

► *Acting on Mr. Hedrick's suggestion, we are reprinting the chart in black (opposite page).—ED.*

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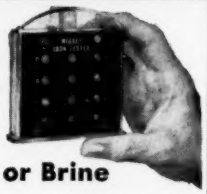

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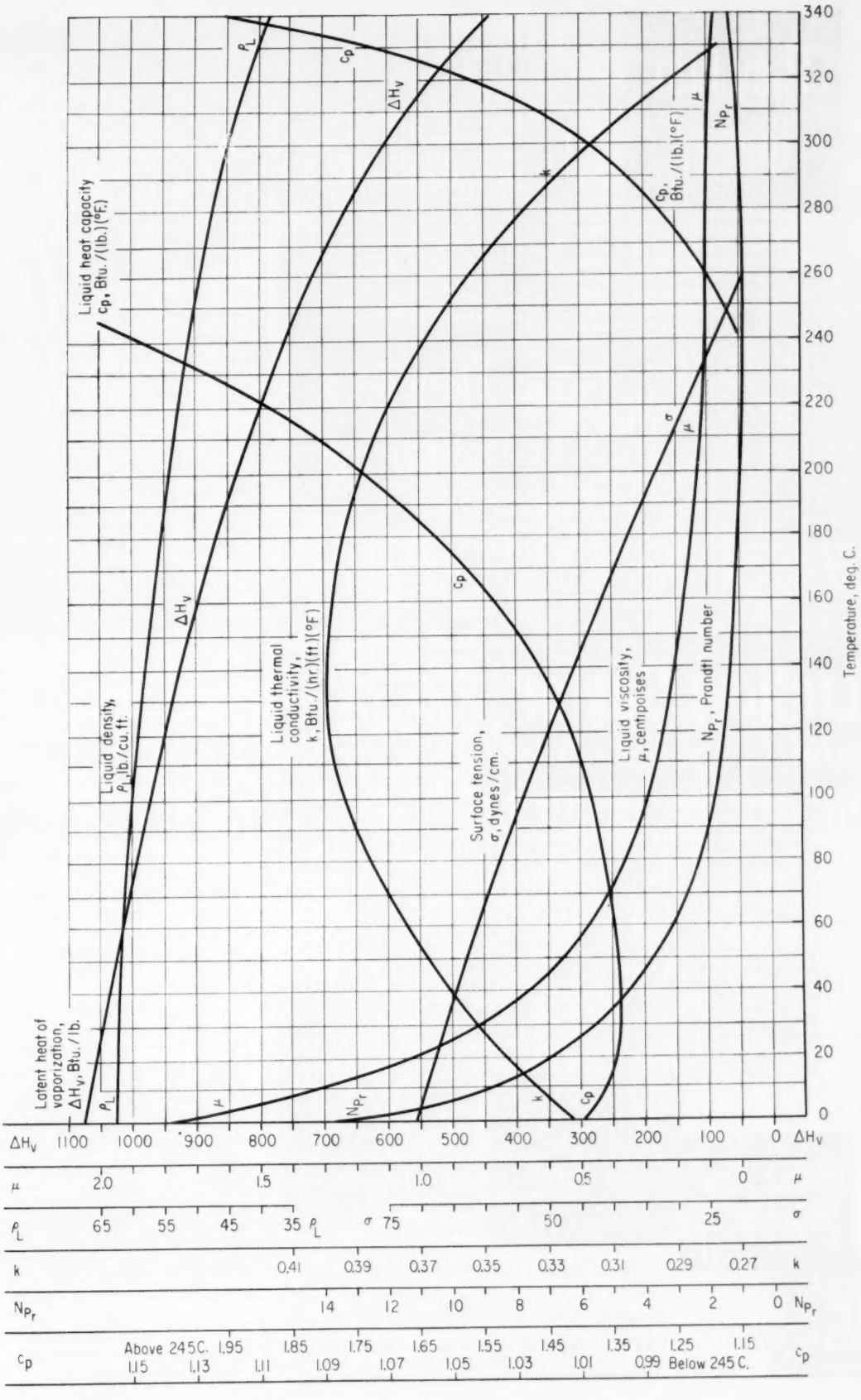
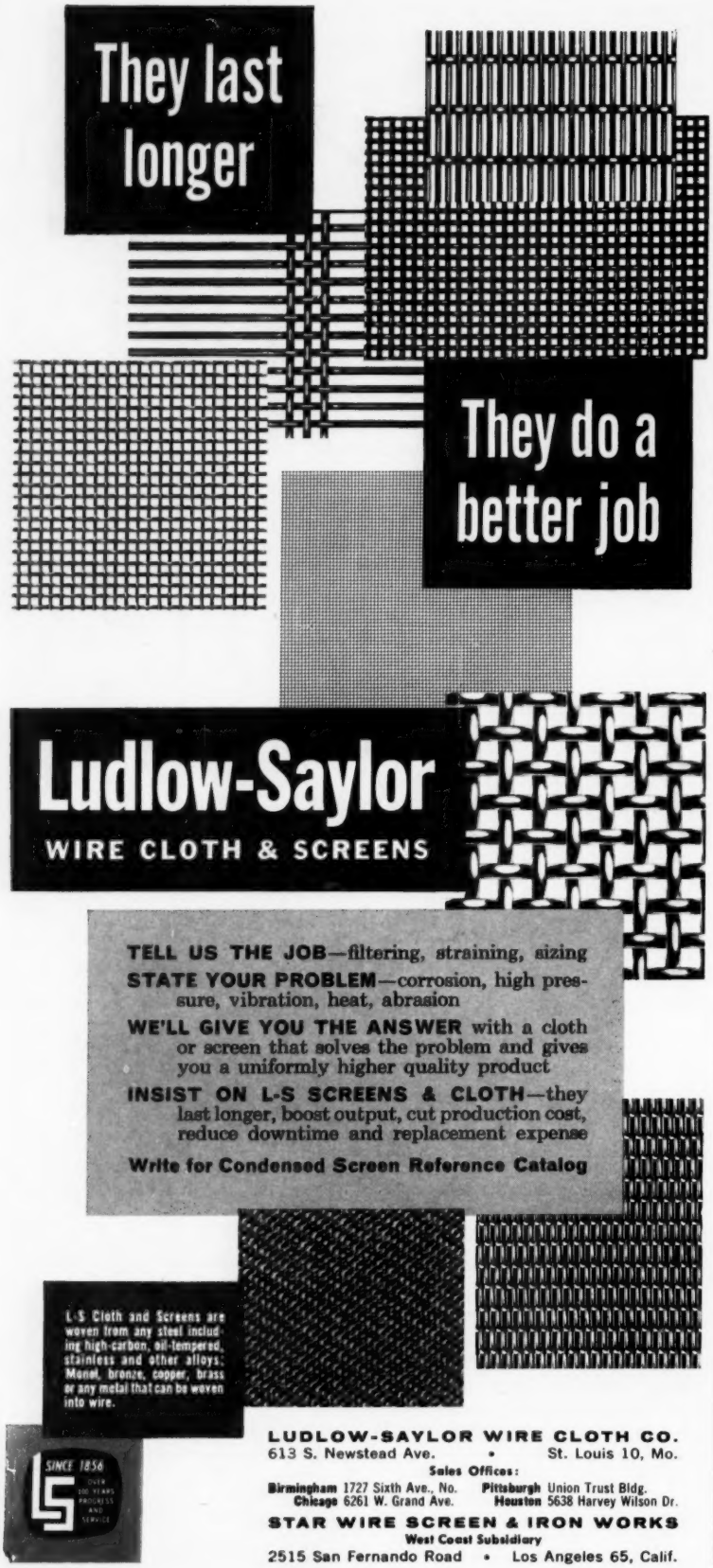
Physical Properties of Water (see letter, opposite page)

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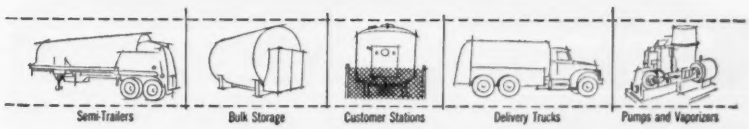

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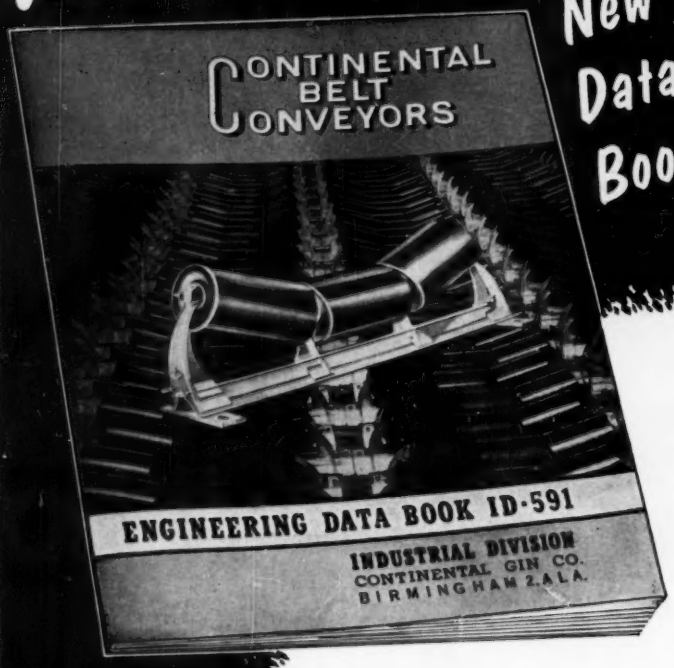

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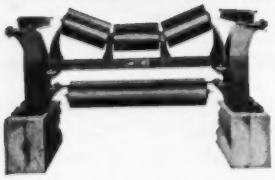

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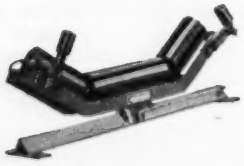

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16-17	43	55	89	101	118	136	203	222a	228	234A	249A	L260	R266	282
18-19	44	56	90-91	102A	119	137	204	222b	228A	234B	249B	R260	266A	283
22-23	45a	57	92A	102B	120	138	L205	222c	229	234C	250	260A	266B	284a
24-25	45b	58a	93	100C	121	139-140	R205a	222d	230	TL235	251	260B	266C	284b
26-27	45c	58b	94A	102C	122	141	R205b	222e	230A	BL235	252	R261	266D	284c
28-29	45d	58c	94B	102D	123	146	206	222f	230B	R235	252A	262	L267	284d
30-31	46	59	94C	102E	124	147	207	220A	231	236	253	262A	R267	284e
32	47	60	94D	102F	125	148	TL208	221A	232	237	254	262B	267A	284f
33	48	61	94E	103	126a	149	BL208	222A	232A	238	255	TL263	267B	284g
34	49	62a	94F	104	126b	150	209	222B	232B	239	256	BL263	267C	284h
35	50a	62b	95	106	127	181	210	223						

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- **ADS**
- **PRODUCTS** Page 98
- **EQUIPMENT** Page 92
- **SERVICES**
- **LITERATURE** Page 248

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64	65	66	67	68	70	72	73	74	75	76	78	79	80	81	82	83	85	86	87	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	107	108	109	110	111	112	113	114	115
117	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139

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2	38-39b	50d	69	96C	109	130	187	213	224c	232E	R240b	TL257	R263c	268A
4	38-39c	50e	71	96D	110	131	189	214	224d	TL233	R240c	BL257	R263d	268B
6-7a	38-39d	51	75	96E	111	132	191	215	T225	BL233	R240d	R257	264	268C
6-7b	38-39e	52	77	98A	112	133	193	216	B225	R233a	241	258	264A	276
6-7c	38-39f	53-54a	79	98B	113	134	195	217	225A	R233b	242	258A	264B	277
8	38-39g	53-54b	81	98C	114	135a	197	218	226	R233c	243	258B	264C	278
9-12	40	53-54c	83	99	115	135b	199	219	226A	R233d	244	TL259	L265	279
13	41	53-54d	85	100A	116	135c	201	220	226B	R233e	248	BL259	R265	280
14-15	42	53-54e	87	100B	117	135d	202	221	227	234	249	R259	L266	281
16-17	43	55	89	101	118	136	203	222a	228	234A	249A	L260	R266	282
18-19	44	56	90-91	102A	119	137	204	222b	228A	234B	249B	R260	266A	283
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28-29	45d	58c	94B	102D	123	146	206	222f	230B	R235	252A	262	L267	284d
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64	65	66	67	68	70	72	73	74	75	76	78	79	80	81	82	83	85	86	87	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	107	108	109	110	111	112	113	114	115
117	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139

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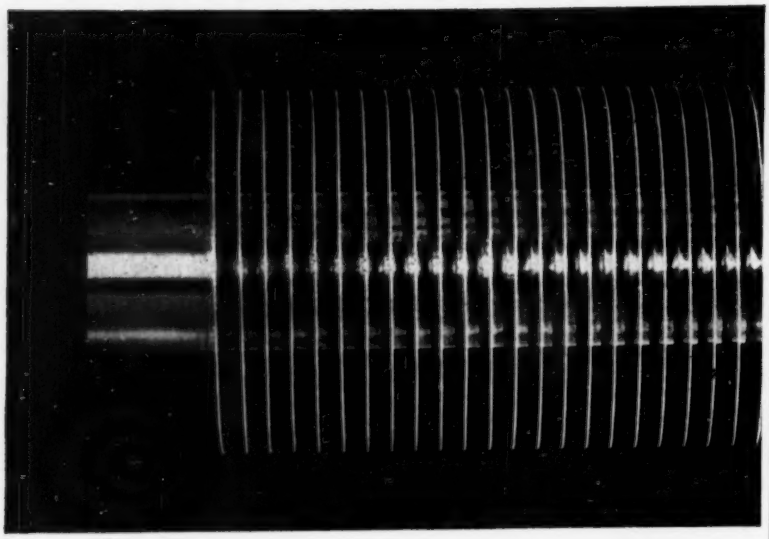

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Contents of This Issue

Chemicals 248
Construction material .. 250
Electrical & mechanical 252
Handling & packaging.. 253
Heating & cooling..... 254
Instruments & controls.. 255
Pipe, fittings, valves.... 258
Process equipment..... 262
Pumps, fans, compressors 267
Services & miscellaneous 268

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Active Aluminas.....A new technical brochure with complete information on the new special alumina products for the petroleum & chemical industries is offered.
220 *Kaiser Chemicals Div.

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183 *Enjay Company, Inc.

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27-27 *Wyandotte Chemicals Corp.

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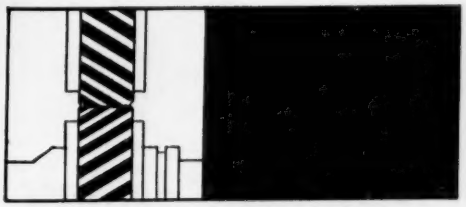

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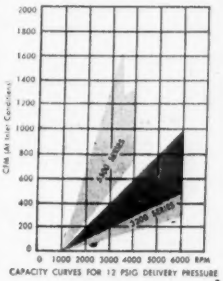

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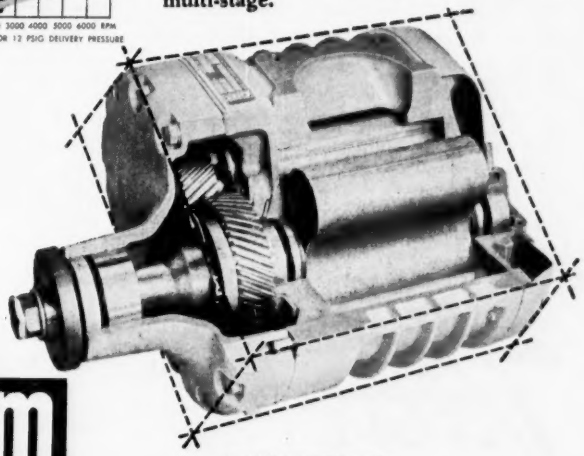

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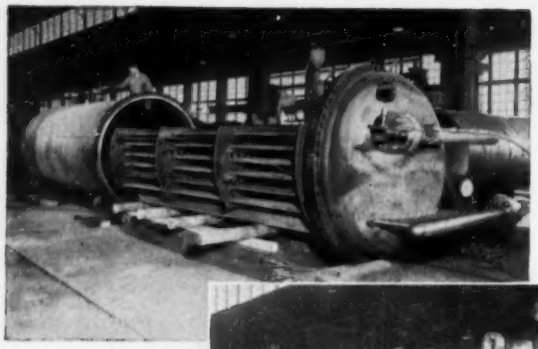
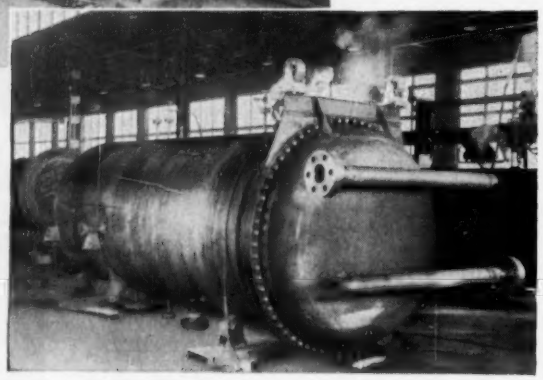


View showing how tube bundle slides out for ease of cleaning.



Vilter Synthesis Heat Recovery unit for Canadian chemical plant. Rollers being welded in place.

Vilter Vessel Salvages "Waste Heat" While Desuperheating Ammonia Gas!

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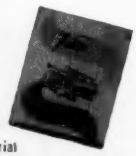

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230 *The Ceilcote Co., Inc.

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L260 *Thermal Amer. Fused Quartz Co.

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Rubber Linings.....expand & contract with the metal under temperature changes . . . won't harden or crack. Offer protection for your processes & equipment.
134 *Raybestos-Manhattan, Inc.

Silicon Carbide.....Crystolon silicon carbide products are available for processes involving heat transfer and abrasion resistance. Catalog 862.
38-39f *Norton Co.

Silicone Heat Resistant Finish..... Brochure shows how Sicon achieves more product appeal . . . withstands 550 F. temperatures without loss of color or gloss.
R267 *Midland Industrial Finishes Co.

Stainless-Clad Plate.....provides same protection against corrosion, abrasion or product contamination as solid stainless steel where only 1 side of plate is exposed. Details.
132 *The Colorado Fuel & Iron Corp.

Stainless Steel.....New booklet gives detailed information on all commercial stainless steel sheet and strip grades produced by company. Comparative corrosion resistance.
252A Washington Steel

Stainless Steel Anchor Bolts.....Information on stainless steels for chemical plant bolting is offered. Special grades of stainless for particular bolting applications.
116 *Armco Steel Corp.

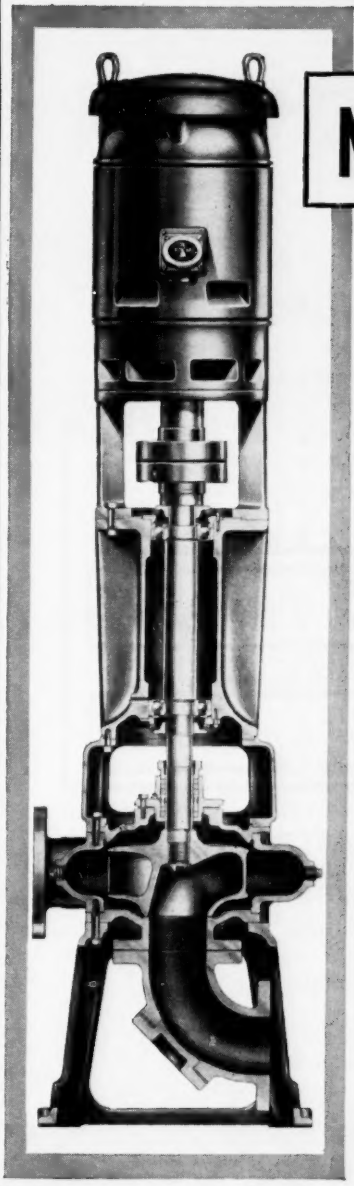
Steel.....Bulletin 20-S describes pipe, tube, strip, sheet, plate, bar, and wire now available in stock for immediate delivery. Send for your copy.
93 *Union Steel Corp.

Titanium.....Technical data sheet on "Titanium Pumps for Chemical Service" is offered. Features outstanding corrosion resistance in pumps & pump parts.
120 *Mallory-Sharon Metals Corp.

*From advertisement, this issue

For higher pumping efficiency

of solids in suspension!



NEW

Fairbanks-Morse

5440A Non-Clog Pumps

Ideal for pumping unscreened liquids with large solids in suspension

- industrial wastes
- sanitary sewage disposal
- industrial processes

Here is your answer to higher efficiencies wherever you are pumping solids in suspension!

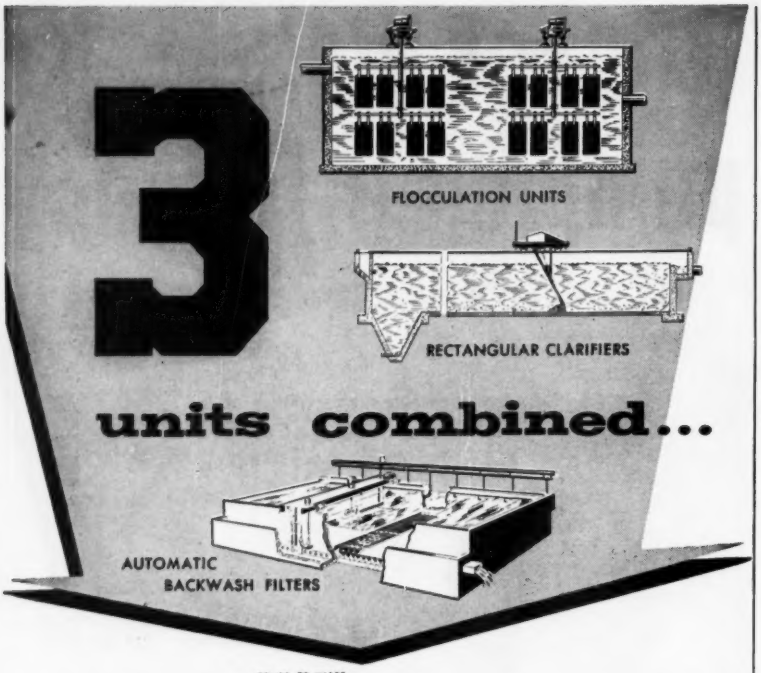
All-new Fairbanks-Morse 5440A Non-Clog Pumps feature quick, easy convertibility between any of the many vertical and horizontal types. Power requirements of the pump are always perfectly matched to the electrical and mechanical components. Precision-machined centering fits assure accurate alignment. Exclusive F-M bladeless impeller design minimizes maintenance by preventing clogging from solids and stringy material. The 5440A is only one of many F-M solids-handling pumps designed to meet a broad range of requirements. For information, write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

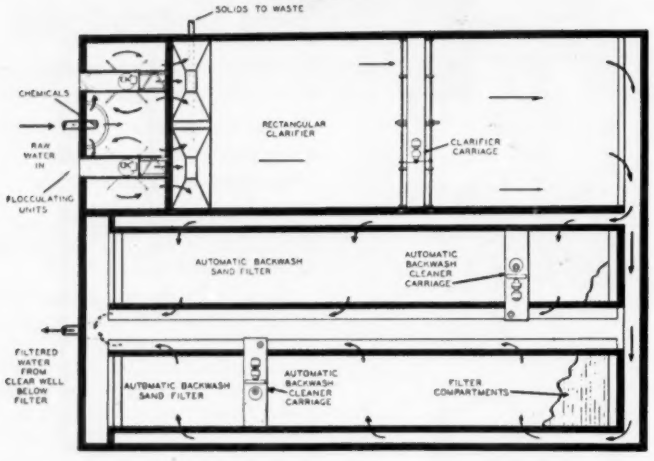
Ask for new 5440A BULLETIN!

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

ELECTRIC MOTORS • DIESEL, DUAL FUEL AND GAS ENGINES • PUMPS
COMPRESSORS • GENERATORS • MAGNETOS • HOME WATER SYSTEMS





...for COMPLETE WATER TREATMENT in Modular Construction

A real "thirst quencher" for industrial and municipal water supplies is the Hardinge equipped water treatment plant—available in unit sizes of from 1 M.G.D. to 5 M.G.D.

Can be furnished complete with automatic plant controls.

Write for full details.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Jacksonville Beach

LITERATURE . . .

Wire Cloth & Screen.....resists distortion, corrosion, heat & pressure. Condensed Screen Reference Catalog gives specifications and other details.
242 *Ludlow-Saylor Wire Cloth Co.

Zinc Dust.....used as a reducing agent, precipitating agent, purifier, catalyst, polymerizing agent, in rust-resistant paints, bleaches, etc. Sample available.
239 *American Smelting & Refining Co.

Electrical & Mechanical

Automatic Expander Drives.....Helpful data on the exclusive design features of Torq-Air-Matic automatic expander drives contained in Bulletin No. 581.
101 *Thomas C. Wilson, Inc.

Connectors & Panels.....Quick-coupling connectors permit fast making & breaking of circuits. Panels are available in many compact shapes & sizes. Bulletin 23-E.
BL263 *Thermo Electric Co., Inc.

Gears, Planetary.....Features many outstanding characteristics such as light weight, in-line construction & space saving. Bulletin 2400. Send for your copy.
90-91 *De Laval Steam Turbine Co.

Mechanical Seals.....Bulletin B-111 contains the complete information on quick-change rotary mechanical seals for pressure & vacuum mixing.
284a *Mixing Equipment Co., Inc.

Motor Starter & Circuit Breaker..... now available in 7″ & 9″ sizes for sizes 1 & 2 starter combinations. Detailed information on the many special features.
64 *Crouse-Hinds

Motors.....for all atmospheric & hazardous conditions. Complete factual information on chemical & explosion-proof motors contained in Bulletin SB-185.
227 *Marathon Electric Mfg. Corp.

Motoreducers.....available in horizontal, vertical & right angle types. Units are available up to 75 hp; output speeds from 780 rpm down to 1.2 rpm. Bul. 3100.
42 *The Falk Corp.

Pump Motor.....Unibase is a vertical pump motor designed for industrial use. It features the exclusive Microset coupling. Details in color brochure. Bul. F-1975.
61 *U. S. Electrical Motors Inc.

Rectifier.....Unitron semi-conductor rectifier lets you use any cell in any position. Further information & copies of recent AIEE papers are available on request.
52 *I-T-E Circuit Breaker Co.

Rectifiers.....such as germanium silicon, & selenium, as well as mercury arc rectifier units of the pumped or sealed type in open or enclosed construction. Details.
217 *Allis-Chalmers

Seal Rings.....Rotary seal rings provide substantially zero leakage at mile-a-minute rubbing speed. Offer positive sealing. Information available.
268 *Kennametal Inc.

* From advertisement, this issue

LITERATURE . . .

Starter, Oil-Break.....are specifically designed for dusty, corrosive atmospheres. They can be quickly installed & feature high interrupt-capacity. Bul. 8130CH.
187 *The Electric Controller & Mfg. Co.

Starters.....Details on combination starter in screw type enclosure for hazardous gas & hazardous dust locations contained in Bulletin 713. Send for your copy.
137 *Allen-Bradley Co.

Switches, Explosion-Proof.....are ideal electrical controls in hazardous areas. Offer precise operation, accurate repeatability, small size, etc. Catalogs 83 & 84.
50a *Micro Switch

Tube Cleaner.....The new lightweight, air-driven tube cleaner for condenser & heat exchanger tubes is outlined in Bulletin Y-48. Easy to handle by one operator.
256 *Elliott Co.

Turbine, Vertical.....has an almost indestructible rotor. It is available in capacities from 5 to 300 HP. Bulletin S-137 gives complete information.
202 *The Terry Steam Turbine Co.

Handling & Packaging

Airstream Conveyors.....carry your dry bulk material to its destination horizontally, vertically, through walls & floor, underground or overhead. Detailed information.
117 *Dracco Div. of Fuller Co.

Conveyors, Belt.....A new data book contains 88-pages of products, installations, diagrams, charts, specifications & tables. Covers all industries. Catalog ID-591.
244 *Continental Gin Company

Drum Vent.....No. 5522 Drum Fitting is a fire & explosion-safe, pressure-vacuum relief vent for installation in 2" end bung opening of drums stored in horizontal positions.
45a *The Protectoseal Company

Feeders.....to meet certain specifications are outlined in bulletins which are available. Also details on auxiliary equipment and instrumentation.
204 *B-I-F Industries, Inc.

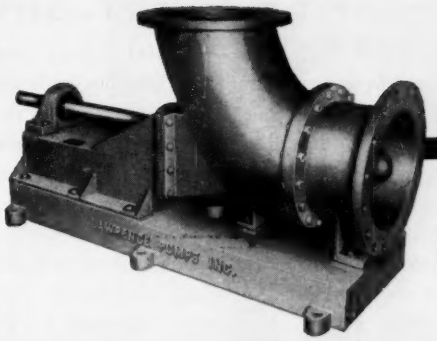
Materials Handling.....The Dumpmaster model CA60-3DB automatically handles detachable containers in 1 to 6 cubic yds. sizes. Can pick up a gross load of 6000 lbs. Brochure.
43 *Dempster Brothers, Inc.

Safety Vent.....Booklet entitled, "Storage Tank Safety Vent Fundamentals" is available immediately. Gives complete data on Flammables Engineering.
45c *The Protectoseal Company

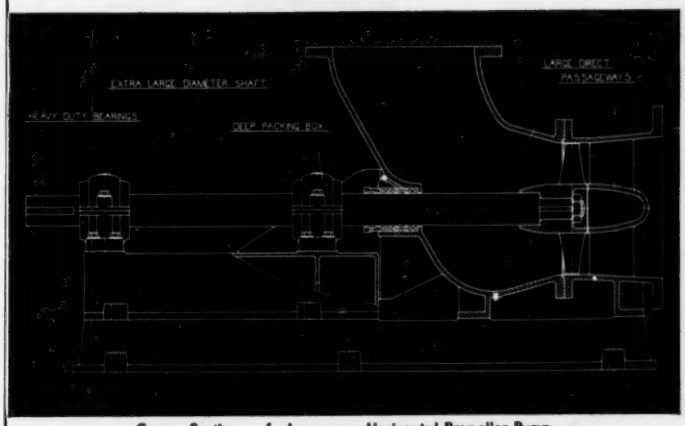
Storage Cabinet.....The Flammable Liquids Safety Storage Cabinet is designed to meet the specifications of the N.F.P.A. Details for on-the-job storing available.
45b *The Protectoseal Company

Tanks.....of carbon & stainless steel for chemical storage. Also pressure vessels & processing equip. of aluminum & special alloys. Booklet "Tank Talks" is offered.
TL233 *R. D. Cole Mfg. Co.

* From advertisement, this issue



Lawrence 24" Horizontal Circulating Pump of Nickel Alloy Construction



Cross Section of Lawrence Horizontal Propeller Pump

PROPELLER PUMPS
FOR THE
CHEMICAL and PROCESS INDUSTRIES

Lawrence Propeller or Axial Flow Pumps are widely used to circulate large volumes of liquid or slurry against low heads as in evaporators, crystallizers, etc. This type of pump is particularly well adapted for circulating service because of its simplicity, high efficiency, and low first cost. The flow can be arranged in either direction and the casing turned to any position desired to serve as an elbow. The capacity can be closely regulated by varying the speed—very important in crystallization processes where a uniform velocity must be maintained.

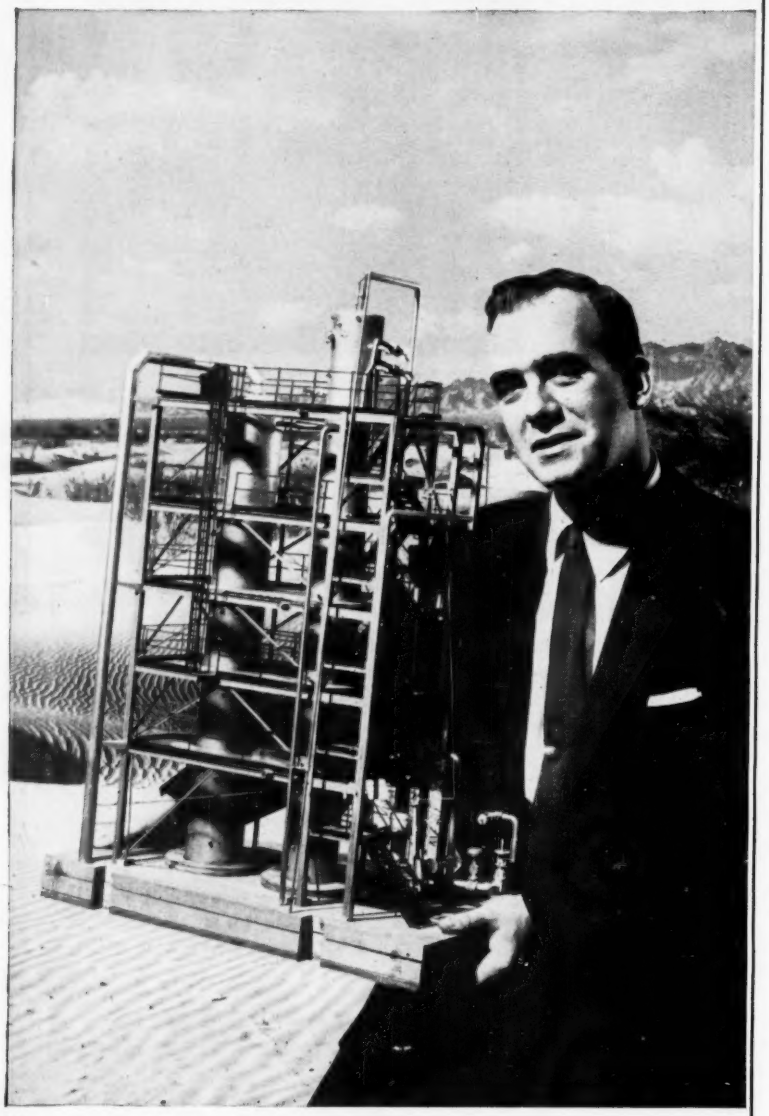
Lawrence Propeller Pumps are made of the metals and alloys best suited for their ability to resist the corrosive and abrasive action of the liquid pumped.

LAWRENCE PUMPS INC.

371 MARKET STREET, LAWRENCE, MASS.

KEEP YOUR PLANT DESERT-DRY WITH LECTRODRYERS—It's like taking your plant to the desert if you eliminate unwanted moisture with Lectrodryers. Controls work smoothly and dependably when instruments are fed dry, clean air. Processes stay on the beam and product quality is consistently high, when the air, gases or organic liquids involved are dry. Desert dryness in warehouses safeguards products stored there.

Lectrodryers dry to dewpoints below -110°F.—in volumes of a few cubic feet or thousands per hour. Operation can be fully automatic or manually controlled. Quite likely, there are standard units to suit your needs, or we can recommend special equipment. For this help, write Pittsburgh Lectrodryer Division, McGraw-Edison Company, 303 32nd St., Pittsburgh 30, Pa.



Lectrodryer® McGRAW EDISON

LITERATURE . . .

Heating & Cooling

Coils, Smooth-Fin . . . . . offer greater heat transfer & lower airway resistance Tapered fin design provides efficient heat transfer surface. Bul. S-55.
248 *Aerofin Corp.

Combustion Systems.....High-velocity air heating combustion systems are individually job engineered using standard components. Complete information on request.
237 *Eclipse Fuel Engineering Co.

Control Instruments.....A complete catalog on Capacitance Instruments is offered. Information on Level-Tel, Level-Tek, Level-Set and Level-Log instruments.
191 *Robertshaw-Fulton Controls Co.

Heat Exchanger.....Sectional Aero heat exchanger gives close temperature control. Capacity range is 7,000,000 to 18,000,000 Btu./hr. Details in Bul. 132.
TL259 *Niagara Blower Co.

Heat Exchanger Equipment.....with working pressures as high as 10,000 psi. Bulletin 827 outlines the industrial heat exchangers that are available.
250 *The Vilter Mfg. Co.

Heater, Hi-Turbiant.....Illustrated Bul. HT-100 gives detailed data & shows typical systems. Two fields of application; heating transfer fluids & direct firing.
147 *Western Precipitation Corp.

Heat Exchanger, Plate.....readily available to meet your specific needs. Temperatures can be controlled to within 1 F. & held exactly for hours on end.
6-7a *De Laval Separator Co.

Heaters, Cartridge.....Diameters from ⅜ to 1-19/64 inches, lengths from 1⅝ to 25⅝ inches. Special leads available for protection against flexing action, abrasion, etc.
224c *Edwin L. Wiegand Co.

Heaters, Electric.....are available in sheath materials & wattages to match almost any application to 1100 F. New Catalog 60 provides detailed product information.
224a *Edwin L. Wiegand Co.

Heaters, Strip.....Lengths from 4 to 96″, widths from ¾ to 2½″, with cross section curving or lengthwise bending. Available with brazed-on fins. Catalog 60.
224d *Edwin L. Wiegand Co.

Heaters, Tubular.....Straight lengths or factory-formed to nearly any contour. Lengths from 6 inches to 30 feet. Triangular or round cross section. Catalog 60.
224b *Edwin L. Wiegand Co.

Heating Mantles.....Glass-fabric type, quartz-fabric type & 650 C Glas-Col "R" type available. Complete line for chem. process, pilot plant and laboratory heating applications.
89 *Glas-Col Apparatus Co., Inc.

Hydro-Steam Unit.....Bul. 5H-HS, complete details on application, construction, operation incl. suction pressures provided & data on steam used & make up water required.
133 *Schutte & Koerting Co.

*From advertisement, this issue

Kilns.....for lime, calcined coke, dead burned dolomite, cement by wet or dry process, nodulizing and agglomerating or drying. Information on request.
141 *Kennedy Van Saun

Liquid Heating System.....operates at atmospheric pressure. Thermally stable, will not air-lock, vapor-bind or flood. Explosion hazards are eliminated. Bulletins.
149 *Allis-Chalmers

Preheater, Air.....Factual information on LJUNGSTROM Air Preheater is contained in a reprint of a published magazine article which is now available.
46 *The Air Preheater Corp.

Pressure Vessels & Heat Exchangers.....Bulletins HE and CI outline the craftsmanship in the design & fabrication of pressure vessels & heat exchangers.
13 *Downington Iron Works, Inc.

Reboilers.....“Karbate” impervious graphite shell & tube heat exchangers provide economic service life as reboilers handling 45-55% sulfuric acid-organic solution.
44 *National Carbon Co.

Steam Generators.....Different types of steam generators are custom designed to solve the specific problems peculiar to individual plant processes.
150 *Henry Vogt Machine Co.

Steam Trap.....combined with fine screen strainer makes a good team for steam. All the details are contained in the “Steam Trap” book that is offered.
R266 *Yarnall-Waring Co.

Steam Traps.....Ductile iron steam traps in pipe sizes from ½” to 2”, capacities to 42,800 lbs. of water per hour. Information on 540 series available.
221 *Strong, Carlisle & Hammond

Thermo Panels.....take the place of pipe coils. Can be quickly installed or removed for cleaning. Complete data, including prices is available. Send for your copy.
TL208 *Dean Products, Inc.

Instruments & Controls

Computer.....GE 312 Digital Control Computer for on-line process computing application in industrial & utility systems. Brochure CPB-36 for more information.
181 *General Electric Co.

Computers, Electronic.....LGP-30 is easy to operate, plugs into any regular wall outlet and is completely mobile. Detailed information & specifications offered.
148 *Royal McBee Corp.

Control.....Handibook, “Modern ph and Chlorine Control” is available. It gives complete theory and describes the complete line of controls.
R240a *W. A. Taylor & Co.

Control, Checkweighing.....Continuous 100% in-line checkweighing of items from 50 to 200 lbs. at speeds to 40 per minute. Handles sacks, cartons, etc. Bulletin 2968.
R205b *Toledo Scale Corp.

*From advertisement, this issue

Sperry Filter Presses can be made with new glass-reinforced Polyester plates and frames.

THE SPERRY FILTER PRESS

Because Sperry Filter Presses are custom engineered for *flexible, volume production* and *elimination* of *waste materials* and *man-hours*, you can expect—and get—more efficient filtration at less cost! With a Sperry Filter Press the low first cost is virtually the only cost! Installation, depreciation and maintenance are minimized; down-time, all but eliminated.

For every industrial need

These important savings are built into every Sperry Filter Press, regardless of design—capacity—or purpose. Depending on your particular requirements, Sperry Presses can be furnished with *any type of plates* made of most materials . . . to provide OPEN or CLOSED DELIVERY: CENTER, SIDE or CORNER FEED: SIMPLE or THOROUGH WASHING: HIGH or LOW TEMPERATURE CONTROL: For using ANY FILTER MEDIA!

FREE SPERRY CATALOG

The outstanding performance of low-cost Sperry Filtration merits your further investigation. Write today for your free copy of the complete Sperry Catalog, including detailed information of Sperry's Plate-Shifters, Closing Devices and other Labor-Saving Accessories.

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D. R. SPERRY & CO.
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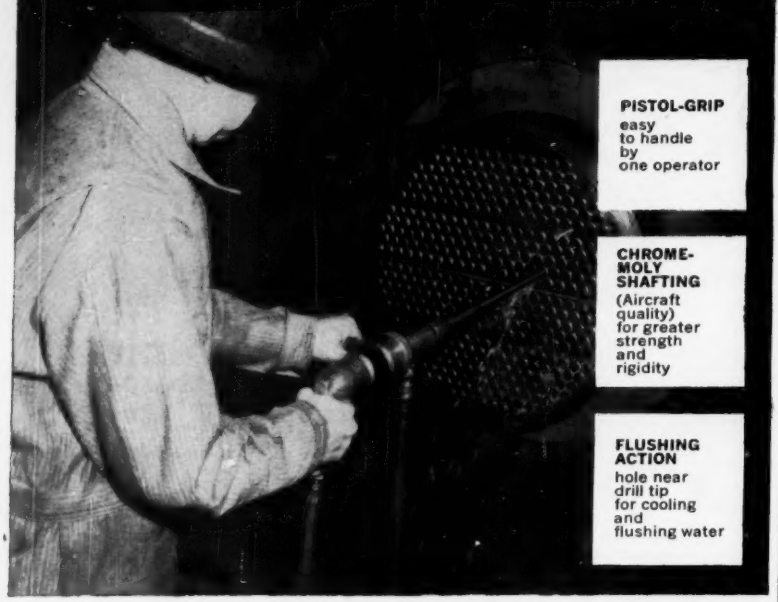
CE-5

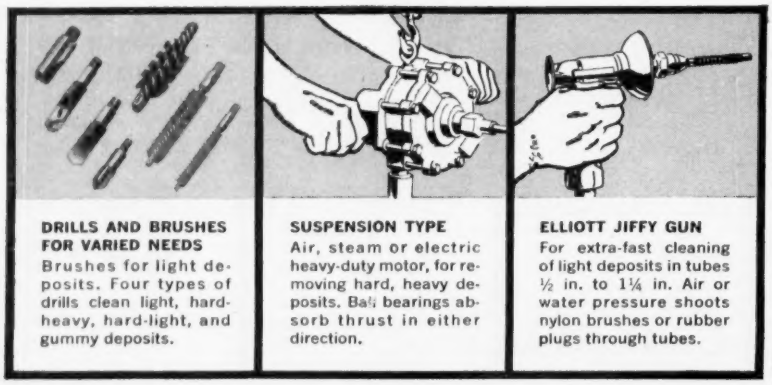
newest ELLIOTT tube cleaner

lightweight! air-driven!



for condenser and heat exchanger tubes

Lightweight. Powerful. Air-driven. Trigger-action control with speed governor to prevent shaft-whip. High-speed motor reduced through planetary gears to 1500 rpm. Integral water-feeding attachment with finger-action valve which controls flow of cooling water into hollow shaft and drill or brush. Built-in oil reservoir. Send for tube cleaner bulletin Y-48.



DRILLS AND BRUSHES FOR VARIED NEEDS
Brushes for light deposits. Four types of drills clean light, hard-heavy, hard-light, and gummy deposits.

SUSPENSION TYPE
Air, steam or electric heavy-duty motor, for removing hard, heavy deposits. Ball bearings absorb thrust in either direction.

ELLIOTT JIFFY GUN
For extra-fast cleaning of light deposits in tubes ½ in. to 1¼ in. Air or water pressure shoots nylon brushes or rubber plugs through tubes.

ELLIOTT Company
Lagonda Plant—Springfield, Ohio

Y9-1

LITERATURE . . .

Control, Pneumatic.....Model RVA-Recording or model IVA-Indicating type pneumatics can be used in systems regulating the flow of steam, water or gas. Details.
56 *The Partlow Corp.

Control System.....Remocon systems provide automatic remote control of single or multiple scale batching systems. Bul. 2964 outlines modern batching equipment.
R205a *Toledo Scale Corp.

Controller.....The Tri-Scope controller features plug-in construction. Either field or panel mounting is available. Full details contained in Bulletin 98332.
24-25 *Taylor Instrument Co.

Controller, Pressure.....Automatic recording pressure controller for homogenizers & high pressure pumps. Offers continuous operation up to 7500 PSI. Bul. RPC-55.
256A Manton-Gaulin Mfg. Co., Inc.

Controls....Test vehicles & pilot plants as well as industrial processes can benefit from the flexibility & simplicity of the Libratrol-500. Descriptive literature.
41 *GPE Controls, Inc.

Gage, Magnetic.....for liquid level observation. Safety design seals against escaping gases. Available with electric alarms. Engineering sheet is offered.
L205 *Jerguson Gage & Valve Co.

Gauge.....Master gauge is available in a wider range of corrosion resistant tubes & sockets. Data is offered to cover your specific needs. Send for your copy.
TL257 *Marsh Instrument Co.

Gauges.....Catalog gives complete data on high pressure gauges, gauge cocks, large chamber reflex gauges & heated or cooled gauges. Send for your copy.
203 *Strahman Valves, Inc.

Level Control.....Electr-O-Probes are available in three models; B-04 super sensitive relay, B-05 general purpose relay, and B-06 self-contained. Bulletins.
BL259 *Instruments, Inc.

Meter.....Complete facts covering all the details of the Magnetic Flow-Meters are contained in Catalog 10D1416 which is now available on request.
104 Fischer & Porter Co.

Process Control System.....The new Electrik Tel-O-Set system consists of a transmitter, receiver, controller & final control element. Complete details available.
139-140 *Minneapolis-Honeywell

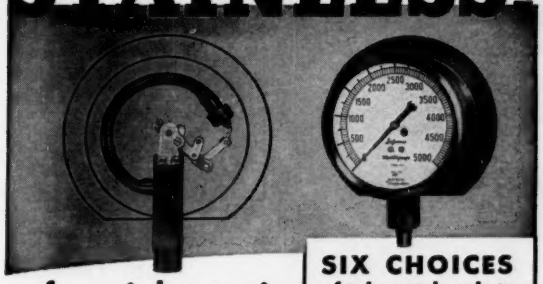
Telemetering Equipment . . . . . Catalog of multichannel telemetering equipment gives clearcut illustrations, and specifications of representative items in manufacturer's line
256B General Devices, Inc.

Thermometer.....Resistance to vibration is built into every thermometer. Handle pressure reading, liquid level, or temperature problems. Details on request.
130 *Rochester Mfg. Co., Inc.

Thermometer, Bi-Metal . . . . . with Maxivision Dial is suitable for indoor or out-door service Sizes & temperature ranges for the most exacting requirements.
34 *Manning, Maxwell & Moore, Inc.

* From advertisement, this issue

STAINLESS!



—from inlet to tip

Now the superlative Mastergauge is available in a wider range of corrosion resistant tubes and sockets than any other pressure gauge.

Check the adjoining list. And remember that tube socket and tip are fused into one piece by the exclusive Marsh "Conoweld" process.

Marsh alone combines the "Conoweld" construction, the copper-clad "Marshalloy" case, the finer Mastergauge movement, the Marsh "Recalibrator", the new "Safecase." Ask for data covering your specific needs.

SIX CHOICES
of tubes and sockets

4130 alloy steel tube with alloy steel tip and socket.

403 stainless steel tube with alloy steel tip and socket.

403 stainless steel tube with 416 stainless tip and socket.

316 stainless steel tube with alloy steel tip and socket.

316 stainless steel tube with 303 stainless tip and socket.

"K" Monel tube with alloy steel tip and socket.

MARSH INSTRUMENT CO., *Sales affiliate of Jas. P. Marsh Corp.* Dept. 24, Skokie, Ill.
Marsh Instrument & Valve Co., (Can.) Ltd. • 8407 103rd St., Edmonton, Alberta, Can.

MARSH "THE STANDARD OF ACCURACY"

Got a STRAINER PROBLEM?

LET MULTI-METAL HELP SOLVE IT

Multi-Metal designs and fabricates STRAINERS TO YOUR EXACT NEEDS—of any metal—from the size of a thimble to cylinders several feet long—as elements only or complete with housings.

- Whether you want to strain slurries of 2000 cps. or 1 cp., at 1 gpm or 20 gpm. — — —
- Multi-Metal-designed strainers can remove particles as small as 10 microns and still keep pressure drop to a minimum.
- There is no limit to design. Where time is important, Multi-Metal's quick opening cover can be furnished.

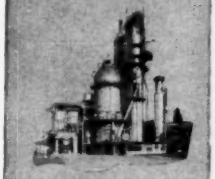
Get our recommendations on your next strainer problem.

MULTI-METAL WIRE CLOTH CO., Inc.

1353 GARRISON AVE., NEW YORK 59, N. Y.

STEEL PLATE
STAINLESS STEEL
STAINLESS CLAD PLATES
T-1 STEEL AND OTHER STEEL ALLOYS
NICKEL-CLAD
ALUMINUM
ETC.

HAMMOND TANKS



FIELD ERECTED TANKS AND VESSELS FOR LIQUIDS, GASSES VAPORS AND STORAGE OF DRY MATERIALS

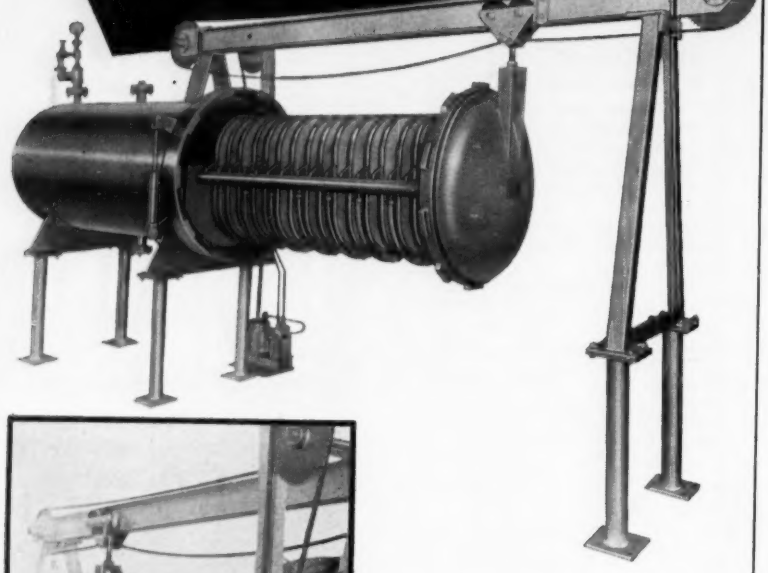
FIRE PROTECTION AND WATER SUPPLY

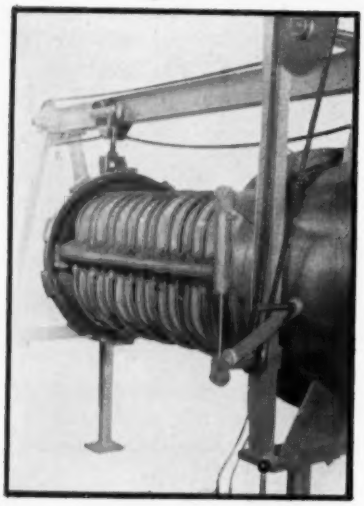
HAMMOND IRON WORKS

WARREN, BRISTOL and PITTSBURGH, PA.
PROVO, UTAH • CASPER, WYO.
BIRMINGHAM, ALA.

Sales offices throughout the U.S.A.

No other pressure filter like it





SHRIVER takes a fresh approach to leaf filters

Here are new design features based on a well rounded 50-year knowledge of pressure filtration applications.

These illustrations, for example, show some novel and important improvements in leaf retraction mechanism and cake discharge, calculated to facilitate operation and cleaning.

Let us show you how the new Shriver filter improvements can help solve your filtration problems. Write for Bulletin 146.

T. SHRIVER & COMPANY, INC.

802 HAMILTON STREET • HARRISON, N. J.

SALES REPRESENTATIVES IN: Chicago, Ill.—Atlanta, Ga.—Houston, Tex.—Detroit, Mich. St. Louis, Mo.—San Francisco, Cal.—Montreal, Que.—Toronto, Ont.

FILTER PRESSES • VERTICAL LEAF FILTERS • FILTER MEDIA
HORIZONTAL PLATE FILTERS • CONTINUOUS THICKENERS
SLAB FORMERS • DIAPHRAGM PUMPS • ELECTROLYTIC CELLS

LITERATURE . . .

Supervisory Equipment.....A detailed discussion of the application and operation of an automatically programmed remote indication logging system is topic of new bulletin.
258A General Electric Co.

Weighing System.....Select-O-Weigh system governs all components required for automatic formulation by weight of any product, liquid or solid. Details.
R265 *Richardson Scale Co.

Pipe, Fittings, Valves

Expansion Joints.....The Expansion Joint Design Guide features 28-pages of valuable information on expansion compensators, flexible connectors, etc.
75 *Flexonics Corp.

Expansion Joints.....Catalog AD-137 covers all-teflon, teflon-lined and all-rubber expansion joints. They protect piping from shock & vibration damage.
107 *The Garlock Packing Co.

Expansion Joints.....made in a wide variety of stainless & high temperature alloys in a range of sizes from ½" to 35 ft. in diameter. A new pamphlet describes the line.
231 *Solar Aircraft Co.

Swivel Joints.....DS series swivel joints are recommended for chemical services ranging from —40° to +400° F & 300 psi. Bulletin 1258 for complete details.
16-17 *Chiksan Co.

Fittings.....Job-matched alloy fittings are available in a complete range of types & sizes in carbon steel & Croloys. Technical data in a new 12-page Bulletin FB-78.
119 *The Babcock & Wilcox Co.

Fittings, Welding.....any type of special fittings made from plate to the most rigid specification. Closer tolerances & quality control. Bul. 5801 for details.
123 *Midwest Piping Co.

Pipe, PVC.....A copy of the new 32-page illustrated catalog on PVC Pipe is now available. There are 400 corrosion resistance ratings available for PVC Pipe.
109 *A. M. Byers Co.

Pipe, Saran-lined.....fittings, valves and pumps are available for systems operating from vacuum to 300 psi, & from well below zero of 200°F. Complete details on request.
129 *Dow Chemical Co.

Spray Nozzle.....“Cant-Clog” spray nozzle is now available as a replacement on all makes of spray equipment . . . as caps only or complete nozzles. Information.
L267 *Carrier Corporation

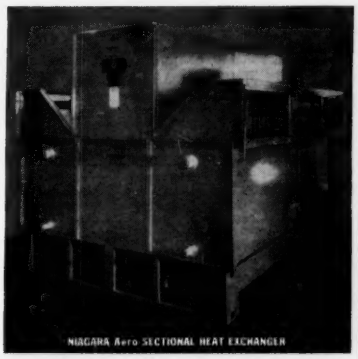
Spray Nozzles.....Complete information on spray nozzles contained in Catalog 24. Offered in a wide range of types & capacities for every application.
TL235 *Spraying Systems Co.

Spray Nozzles.....Catalog contains 32 pages of complete listings and data on all types of nozzles for industrial spraying applications. Spray angles, dimensions, etc.
258B Wm. Steinen Mfg. Co.

* From advertisement, this issue

This Self-Contained Fluid Cooling System

...gives most accurate temperature control



Applied in cooling industrial machines or processes to temperatures approaching the ambient wet-bulb, the NIAGARA *Aero* HEAT EXCHANGER is independent of any more than a nominal water supply or disposal. The coolant system is a closed one, free from dirt and maintenance troubles.

Heat is removed from your process *at the rate of input,* giving you precisely the temperature you require and assuring the quality of your product. Heat may be added to prevent freezing in winter or for better control in a warm-up period. Liquids or gases are cooled with equal effectiveness.

Heat is rejected outdoors. Only the little water evaporated on the cooling coils in the air stream, or discharged to prevent hardness build-up, is consumed.

Niagara sectional construction saves you much installation and upkeep expense, gives full access to all interior parts and piping. Your equipment always gives you full capacity and "new plant" efficiency.

Write for Niagara Bulletin No. 132 for complete information

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Dept. CE-5, 405 Lexington Ave., New York 17, N.Y.

District Engineers in Principal Cities of U. S. and Canada

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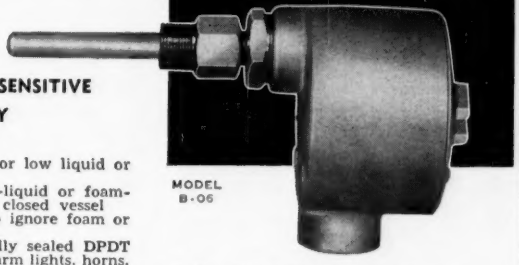

A CAPACITANCE-ACTUATED SUPER-SENSITIVE ELECTRONIC RELAY

1. Will indicate high or low liquid or solid level
2. Will control liquid-liquid or foam-liquid interface in closed vessel
3. May be adjusted to ignore foam or detect foam
4. Contains hermetically sealed DPDT relay to energize alarm lights, horns, solenoid valves, motor starters, etc.
5. Teflon covered probe

ELECTR-O-PROBES are available in three models —

B-04 — super-sensitive relay for foam, interface, etc.
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B-06 — self-contained, general purpose, tank-side mounting

ELECTR-O-PROBES are used NOW for detection of heavy fluids, acids and fluid interface in chemical plants; alarm for refrigerant control in freezing plants; mixed feed control; water-oil interface in refineries; detection of liquors and foam in pulp and paper mills.

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INSTRUMENTS, INC.

BOX 556 TULSA, OKLA.

PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

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..in Wax Emulsions art, engineering, and witchcraft are the ingredients for good wax emulsion. When Commonwealth Color and Chemical brought in some wax emulsions for tests, our spirits waned a little because as every good chemist knows, wax emulsions are fickle. However, the art was good, and our Rapisonic was soundly engineered. The immediate test results were very gratifying.

A short while later our happiness was complete when we added Commonwealth Color and Chemical to our ever growing list of friends and users. The tremendous disruptive forces of cavitation developed right inside the liquid by the Rapisonic gave them results at a speed which had to be seen to be believed.

Thus another happy marriage of chemistry and engineering and...a little more grist to our mill.

..in Adhesives ultrasonics puts stickem in adhesives, too. Apparently someone who was frustrated as a child pasting with flour and water finally developed a really sticky adhesive. But his success story stuck in his customers' mind only after he ran it through the Rapisonic. Result: the finest texture and stickiest film yet.

Sonic Homogenizers develop and use all the energy right in the liquids with only 1/6 to 1/10 the power, and at a fraction of the first cost, of conventional equipment . . . maintenance-negligible.

The Minisonic...for small batches

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SANISONIC ...meets sanitary requirements

AUTOSONIC ...continuous supply

DISPERSONIC ...abrasive emulsions

Sonic homogenizers can give you a superior emulsion, too. Send for technical bulletin

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FOR THERMAL SHOCK RESISTANCE, CHEMICAL INERTNESS IN TUBING

Sand-surfaced, glazed or satin-surfaced and transparent . . . in all normal lengths and diameters. Homogeneous, transparent, free from chemical impurities. Useful to 1000°C.

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FOR OUTSTANDING ELECTRICAL PROPERTIES, STRENGTH, IMPERMEABILITY IN ELECTRIC IMMERSION HEATERS, BALL & SOCKET JOINTS, STANDARD TAPER JOINTS, GRADED SEALS

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Name & Title _____
Street _____
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Zone____State____

LITERATURE . . .

Tubing.....New AX tubing is available in Bronze, Stainless Steel & other metals & alloys from 4-½" I.D. to 14" I.D. . . . to handle axial & lateral movement.
229 *The American Brass Co.

Valve.....The Controller-Positioner-Valve provides modulating control of critical processes. Complete details & specifications covered in Bul. JC-756.
216 *Robertshaw-Fulton Controls Co.

Valve.....The new "O-Seal" valve features two teflon "O" rings in the plug which give constant vapor-tight shut-off. A new brochure on these valves is offered.
113 *Wedgeplug Valve Co.

Valve, Ball in pipe sizes ¼" to 8" in Bronze, Aluminum, Stainless Steel, Carbon Steel & PVC Quarter Turn. Literature on "Ball Valve" Principle.
206 *Jamesbury Corp.

Valve, Ball.....The new "316" gives positive sealing over a wide range of pressures. The new Full-Flow ball valves Catalog No. 57 outlines all the facts.
55 *Rockwood Sprinkler Co.

Valve, Ball.....Complete technical information on the "ECON-O-MISER" ball valve is contained in a new "Comparison bulletin which is offered. Bul. EB 101.
14-15 *Worcester Valve Co., Inc.

Valves.....made in Aloyco 20 are specified for handling spent & slude acids, as well as finished strong acid & oleum. First in corrosive service.
51 *Alloy Steel Products Co.

Valves.....“Craneloy 20” valves for acid service. Circular AD-2080 will bring you up to date on corrosion-resistant alloy valves. No leakage, galling or seizing.
95 *Crane Company

Valves.....Air-Actuated Sanitary valves assure maximum uninterrupted flow, with a minimum of agitation & friction. Can be locally or remote controlled. Bul. A-658.
111 *Ladish Co.

Valves.....Complete details on how the new coated valves can help you solve your corrosive flow control problems is available. Also facts on weld-coat “hard-faced” valves.
125 *Rockwell Mfg. Co.

Valves, Diaphragm.....of ductile iron with glass lined bodies. Feature a wide selection of body linings; glass, rubber, neoprene. Bonnet materials; ductile iron, grey iron.
48 *Grinnell Company, Inc.

Valves & Fittings, PVC.....All parts are made of plastic. Valves & fittings have high burst strength. Newest literature on the complete line is now available.
138 *Walworth

Valves, Packless.....Catalog lists the principal types of packless valves available as well as a special line of solder fittings for high vacuum work. No. V Al.
260A Hoke Incorporated

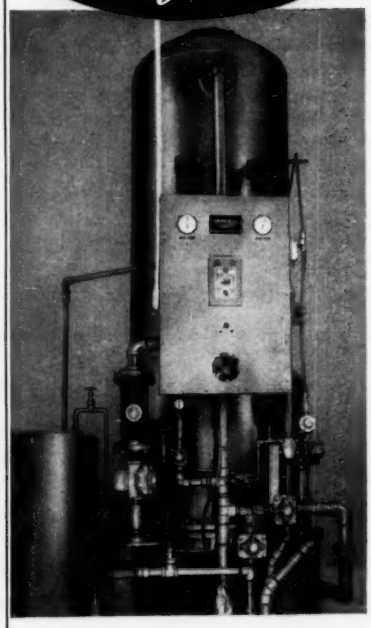
Valves, Fittings, Piping.....Catalog 356 contains complete details including charts, diagrams & other illustrations on jacketed piping, fittings, plug valves, joints, etc.
260B Parks-Cramer Co.

* From advertisement, this issue

Need Ultra-Pure Process, Make-Up or Rinse Water?

Check the pioneer maker* of "Packaged" Demineralizers

Penfield



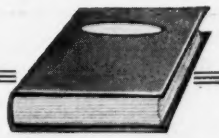
- **Purity in excess of 15-meg ohms** — where you need it, in the quantities you need.
- **Fully Automatic Operation** — set one switch to accomplish entire regeneration cycle.
- **Shipped Completely "Packaged"** — each unit is ready to operate when you receive it.

Penfield Demineralizers are available in mono-column, dual-column and multi-column types — in flow rates from 10 to 10,000 G.P.H. Fifty standard models to choose from. If complete system engineering is needed, that's a Penfield specialty too.

Write today for full catalog information. If possible, give flow rate and purity requirements.

PENFIELD
MANUFACTURING CO., INC.
19 High School Ave., Meriden, Conn.

**Penfield pioneered "packaged" demineralizers for American industry — and remains today the only manufacturer exclusively making demineralizing equipment.*



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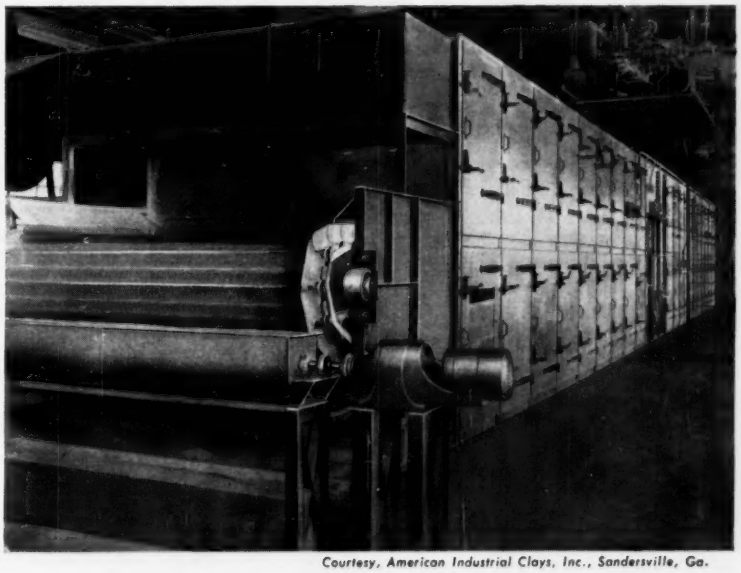
Whatever your needs, there's a SARGENT to do the job. SARGENT Dryers are working in widely varied industries — chemicals, rubber, food, tobacco, textiles — wherever there's a drying process. They are pre-dominant, industry-wide, in profitable operation. Each dryer has these "plus" advantages, standard in every SARGENT machine:

- Exclusive, pre-assembly method means record-breaking speed of installation at your plant.
- Heat source can be gas, oil, steam, electricity.
- Economical — use as little as 1.2 lbs. steam per pound of water removed.
- Drying uniformity; trouble-free operation.
- Rugged construction; takes the gaff of heavy volume production.
- Complete, hold-to-the-line, temperature and humidity controls.
- Dependable, high-level production at unprecedented economy.



Courtesy, American Industrial Clays, Inc., Sandersville, Ga.

SARGENT 2-Stage, Kaolin Dryer With Extruder

To meet required hourly production in design of this dryer, local conditions suggested the economy of using both gas and oil for the heat source. Combination type burners using both fuels on the same equipment, were therefore incorporated in its design for installation on top of the dryer housing with platforms for inspection and maintenance.

This SARGENT 22-section, 2-stage dryer delivers large tonnage hourly of filler or coating clays. Entering moisture is usually 35% wet basis; and leaves the dryer at 2% or less moisture content, as required. The unique SARGENT double hopper extruder feeds the dryer with a very even porous bed of clay on the dryer conveyor. Simple adjustments easily adapt this machine to various densities of clay.

Another example of SARGENT modern design and advanced engineering in building dryers to meet varying requirements.

C. G. SARGENT'S SONS CORPORATION

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Distill up to 4000 pounds per hour for less than 1/10 cent per pound!

NEW CEC continuous production HIGH-VACUUM STILLS

- Lower operating cost than any other chemical process: .06 to .1 cent per pound.
- High throughput, continuous operation: 4 sizes, from 2 to 4000 pounds per hour.
- Safe! Low-speed rotor. No possibility of oxidation.
- Simplest operation. Low maintenance—runs virtually unattended.
- Highest yield—less product loss from decomposition or molecular rearrangement of heat-sensitive materials.

WRITE for specifications and application data, Bulletin 3-1 . . . and for information on test runs of your samples.

Now CEC stills give you the most economical and efficient way to separate organic and silicone compounds from 250 to 4000 molecular weight; for example:

Fatty acids
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Rochester Division CEC

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Process Equipment

Additive Blender.....New bulletin describes the Proportioneers metering-type additive blender that automatically proportions liquid additives to fuel oil streams.
262A B-I-F Industries

Agitators.....Impellers help to make your process mixing more efficient. Bulletin 581 outlines design & performance of impellers. Also covers engineered agitation.
87 *New England Tank & Tower Co.

Centrifugal.....Continuous solid bowl centrifugals come in 7 sizes. Separating force can be gentle or as high as 3000 g. Operation can be pressurized if need be.
2 *Bird Machine Co.

Compacting System.....is a package of integrated equipment; the new compacting mill, a roller mill & either a gyratory or vibrating screen. Details in Bulletin 07B8836.
215 *Allis-Chalmers

Cone Crushers.....Rugged yet lightweight, Symons cone crushers come in 22- and 30-in. sizes with fine or coarse crushing cavities for reduction crushing. Bulletin.
262B Nordberg Mfg. Co.

Crystallizers.....Krystal crystallizers assure product purity, product uniformity, & product quality. Feature a free-flowing product & minimum caking. Bul. CE-57.
115 *Struthers Wells Corp.

Demineralizers.....are available in mono-column, dual-column & multi-column types . . . in flow rates from 10 to 10,000 GPH. Fifty Standard models. Catalog.
R260 *Penfield Mfg. Co., Inc.

Dryer.....Lectrodryer dry air to dewpoints as low as 110 F. Automatic or manually controlled units for continuous or intermittent operation are available.
254 *Pittsburgh Lectrodryer Div.

Dryers.....Technical literature on prepackaged vacuum tumble dryers available. Also details on the pretesting facilities that are at your disposal.
66-67 *Patterson Kelley Co., Inc.

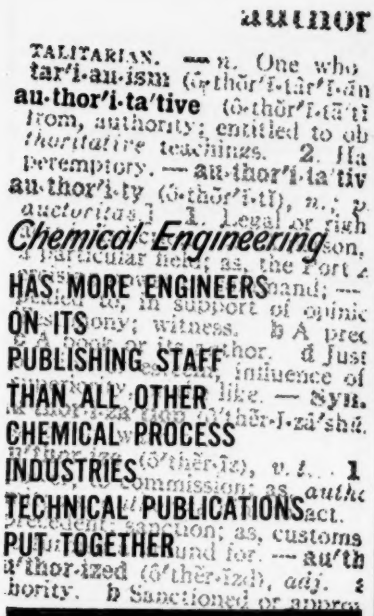
Dryers.....In rotary vacuum dryers the blade clearance is adjustable down to ⅛ inch. Full information on cone vacuum dryers, drum dryers & flakers is available.
110 *F. J. Stokes Corp.

Dust Control.....Duclone cyclone dust collectors are available in a wide range of capacities & in multiple units & special materials to meet all needs. Bul C-958.
106 *The Ducon Co.

Filter.....Model HR offers horizontal plate cake stability plus dry cake discharge . . . all automatic. Complete details on this new filter are available.
32 *Sparkler Mfg. Co.

Filter Papers.....are used in plate & frame presses, horizontal plate, sheet & pad, ceramic gravity, etc. Samples of filter papers are now available.
TL263 *The Eaton-Dikeman Co.

*From advertisement, this issue



Transfer Many Thermocouples
With T-E Quick-Coupling Connectors and Panels
Connector Panels T-E has one for your exact needs. These panels provide flexible, centralized control in transferring any number of thermocouples to indicating, multi-point recording and controlling pyrometers. Ideal for patch panel use, they are available in many compact shapes and sizes — with interchangeable plugs and jacks in I-C, C-C, and C-A. A panel for 48 thermocouples and 16 pyrometers measures only 13¼" x 7⅞". Polarity markings and screw-fastened connections make wiring easy.
Quick-Coupling Connectors These connectors permit fast, easy making and breaking of thermocouple circuits. Durable construction guarantees long, dependable usage. Polarized and mechanically interchangeable, all plugs and jacks are of standard matched thermocouple materials. Spring-loaded contacts with long wiping surfaces provide firm but easily broken connections.
Write for Bulletin 23 — E
Thermo Electric Co. Inc.
SADDLE BROOK, NEW JERSEY
In Canada — THERMO ELECTRIC (Canada) Ltd., Brampton, Ont.

TRAMP IRON TROUBLE?

then Stop Product Contamination and Machinery Damage with

DINGS MAGNETIC SEPARATORS

Permanent Alnico Plate Magnets designed to remove iron from rapidly moving material. The revolutionary step face, plus a wide gap between poles, attracts and holds more tramp iron from greater distances. Perma-Plates are the most versatile, simplest, and least expensive magnets available for easy installation in chutes or ducts, or over belts.

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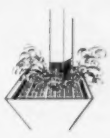

Permanent Alnico Grate Magnets provide powerful attraction for fuzz iron as well as larger pieces to protect trouble spots which are difficult to guard effectively. Wing type Grate Magnets are quickly installed in, over, or under hoppers of any shape, and in floor openings. Drawer type units provide positive protection in enclosed chutes or ducts. Recommended for powders and granular material. Any desired size, or special sizes and shapes, available to meet your requirements.

Permanent Alnico Magnetic Drums assure efficient low-cost removal of tramp iron in spots where other types of magnetic separators cannot be used. They can be installed as an integral part of processing machinery, or used alone beneath apron conveyors, chutes or spouts. Operation is completely automatic, requires no attention and little maintenance.

Write for complete details of the units shown here, or ask for information about the many other models and types in the complete Dings line.

ML-158-1/3

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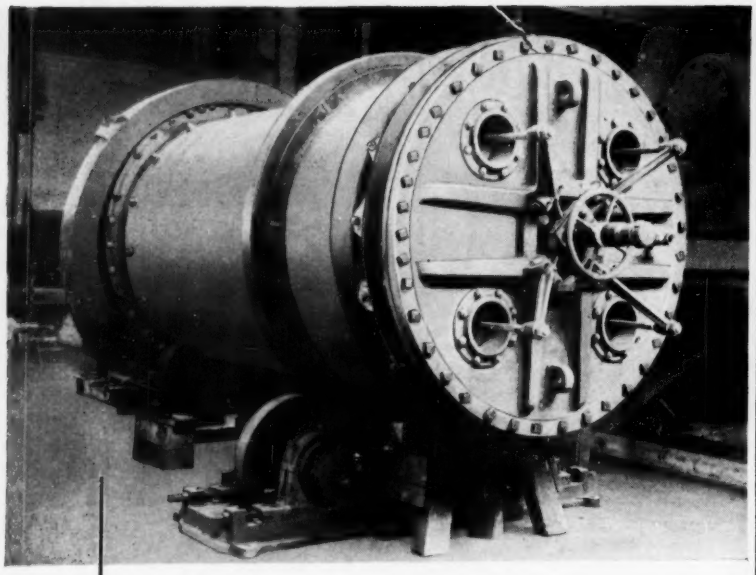

Burt Filter

FOR
- **RECOVERING LIQUIDS FROM PULPS**
- **LEACHING AND FILTRATION**

The Burt Filter is used for recovering liquids from pulps; and for doing both leaching and filtration without use of auxiliary drums or agitators.

It is a batch type pressure filter, but controls can be added to make its operation automatic except for discharging the residue. Continuous movement of the pulp in the rotating drum results in efficient washing and filtration. The filter cake may be washed as many times as necessary. The Burt Filter will handle granular type materials which will not form a cake on other type filters.

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Manufacturing Division

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Sales Agents in Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.

LITERATURE . . .

Filter, Rotary Pressure.....Data is available on these filters & filters for your individual requirements. Details on size, construction materials, etc.
114 *American Machine & Metals, Inc.

Filters.....New FPT filters are completely resistant to chemical attach & ideally suited for filtration of liquids, gas diffusion & purifications. Bul. FPT-2
228 *Chem Flow Corp.

Filters.....Bul. KSI-3 contains illustrations & specifications of Drum filters & Continuous Precoat filters. Also covers Pilot Plant filters & testing facilities, Horizontal filters.
264A Komline-Sanderson Engr. Corp.

Filters.....Catalog, including detailed information of plate-shifters, closing devices & other labor-saving accessories for your filtration proplems is offered.
255 *D. R. Sperry & Co.

Filters, Hydraulic Oil.....Hyflow oil filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, & keeps your hydraulic system clean. Booklet.
236 *The Hillard Corp.

Filters, Pressure Leaf.....Bulletin No. 146 outlines the horizontal tank, vertical leaf filters and the vertical tank, vertical leaf filters. Send for your copy.
258 *T. Shriver & Company, Inc.

Flotators.....An eight-page brochure describes flotators and auxiliary equipment of the manufacturer. Liberally illustrated with flowsheets, schematics, photographs.
264B Process Engineers, Inc.

Gas Scrubbers.....A new brochure giving complete data on Chemico venturi gas scrubbers is available. Their simple construction permits wide application.
35 *Chemical Construction Corp.

Generator.....Inert Gas Generators stand up under the toughest conditions, yet produce with complete dependability. Bulletin D-102 gives complete information.
201 *The C. M. Kemp Mfg. Co.

Homogenizer.....Brochure outlines the use of homogenizers in the textile industry. Illustrations of homogenizers in use & specifications of Model TE.
264C Manton Gaulin Mfg. Co., Inc.

Homogenizers.....Technical bulletins with information on the Homogenizer, Sub-Micron Disperser or Colloid Mill are now available for all processing problems.
278 *Manton Gaulin

Homogenizers.....develop & use all the energy right in the liquids with only 1/6 to 1/10 the power. Technical bulletin gives all the facts. Send for your copy.
R259 *Sonic Engineering Corp.

Impact Mill.....Literature on Impact Milling, Particle Size Reduction and the new line of Vibrating Screens is now available. Feature Minimum temperature rise.
BL235 *Safety Industries, Entoleter Div.

Laboratory Vacu-Film Processor..... Areas of application, from isolation of essences & removal of odors & color bodies to purification of pharmaceuticals, etc. Bul. PE-108.
62a *Rodney Hunt Machine Co.

* From advertisement, this issue

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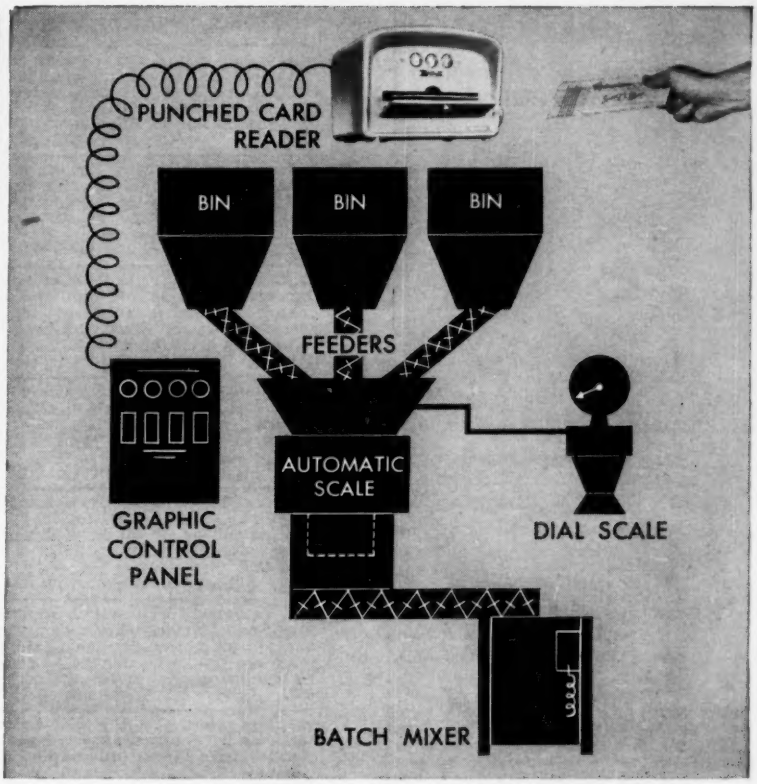
PIONEERS IN CALCIUM SILICATE INSULATION



RICHARDSON SELECT-O-WEIGH

AUTOMATES

FROM BIN TO BATCH

The Richardson Select-O-Weigh system governs all components required for automatic formulation by weight of any product, liquid or solid, involving any number of ingredients.

Programming – by a Punched Card Reader or alternate control systems

Flow Control and Indication – at one remote control panel, housing complete process circuitry

Feeding – feeders engineered for specific materials and needs

Weighing – by Richardson Automatic Scale, accurate to 1/10 of 1%

Mixing – of ingredients in completed batch

Readout – counters, totalizers, printers, typewriters, recorders of all types

When required, service is available from Richardson's nationwide network of service facilities . . . within 24 hours. Custom-engineered by the world's foremost manufacturer of automatic weighing and proportioning equipment, Select-O-Weigh helps you make a better, more uniform product, at lower cost. For full details write, wire or call today.

Richardson Scales conform to U.S. Weights and Measures H-44 *for your protection.*

Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

RICHARDSON SCALE COMPANY • CLIFTON, NEW JERSEY

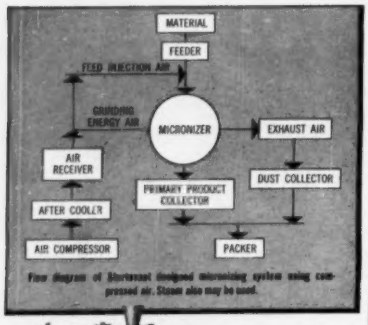
Sales and Service Branches in Principal Cities

Also Manufactured in Europe to U.S. Standards

1558

Need ½ to 44 Microns?

Sturtevant Micronizers* Make 325 Mesh Obsolete



Flow diagram of Sturtevant designed micronizing system using compressed air. Steam also may be used.

One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber—provide fines in range from ½ to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

Production Model (15 in. chamber)

No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

Classifying is Simultaneous

Centrifugal force keeps oversize material in grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size.

Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size (½ to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

Engineered for Special Needs

A 30 in. Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details. STURTEVANT MILL CO., 100 Clayton St., Boston, Mass.

*REGISTERED TRADEMARK OF STURTEVANT MILL CO.

LITERATURE . . .

Micronizer.....grind and classify in one operation in a single chamber. Can handle heat-sensitive materials. Eight models available . . . for full description Bul. 091.
L266 *Sturtevant Mill Co.

Mills, Impact.....Bulletin covers the most efficient method of achieving particle size reduction by centrifugal force. Available in sizes to meet your requirements.
266A Safety Industries, Entoleter Div.

Mixers, Centrifugal.....Bulletin covers the new principle of high speed mixing producing intimate dispersion. Compact unit adaptable to continuous or batch system.
266B Safety Industries, Entoleter Div.

Mixers.....Condensed Catalog (B-109) shows all types of mixers. Other bulletins are available for information on particular type mixers for special applications.
284b *Mixing Equipment Co., Inc.

Mixing.....Mix-Muller offers 3-way kneading, smearing, spatulate action. "Handbook on Mulling" as well as a list of Mix-Muller users are available.
211 *National Engineering Co.

Process Equipment.....Gyro-Testers are used commonly for pilot scale work in processing plants to determine the nature of full scale processing operations. Information.
6-7b *De Laval Separator Co.

Process Equipment.....Super-D-Canters handle a broad range of materials from basic inorganic & organic chemicals as alkali, reaction chemicals, etc.
136 *The Sharples Corp.

Process Equipment....Bul. 25 describes & illustrates Mesh Demisters (entrainment separators—mist eliminators) including applications, performance & engineering data.
1 *Otto York Co.

Screens, Vibrating.....The important new design and high capacities for long life under rugged conditions are outlined in bulletin. All sizes are available.
266C Safety Industries, Entoleter Div.

Sifters.....The super active ball cleaning device provides rebound points in each ball compartment, assuring fast, thorough shifting of your product. New ro-ball bulletin.
218 *The J. H. Day Co.

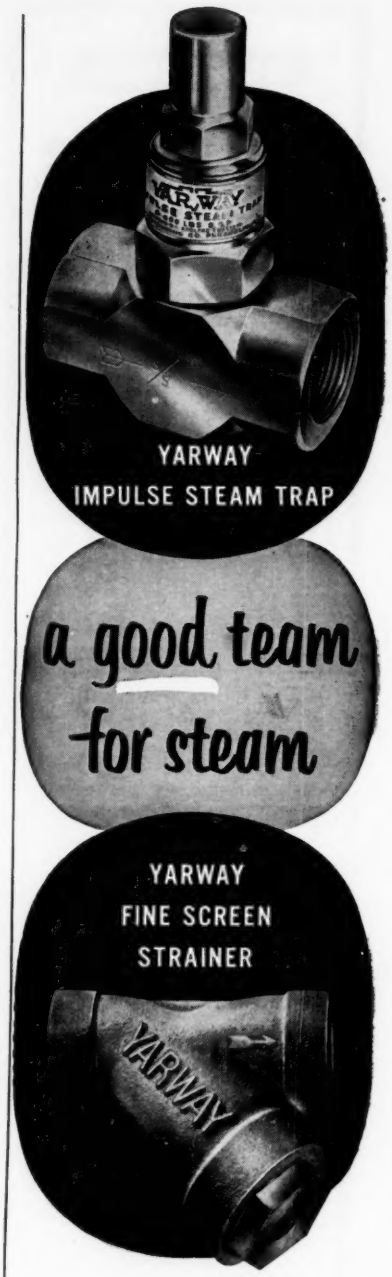
Stills, High Vacuum.....available in 4 sizes from 2 to 4000 pounds per hour. Specifications & application data contained in Bulletin 3-1. Send for your copy.
262 *Consolidated Electrodynamics

Strainers.....Automatic self-cleaning strainers for efficient removal & disposal of suspended particles from raw or process water & other liquids. Bulletin 500.1C.
T225 *S. P. Kinney Engineers, Inc.

Turba-Film Processor.....consist of a series of rotor blades operating within a thermal section & a separating section . . . all fabricated of alloy steel. Literature.
62b *Rodney Hunt Machine Co.

Vertical Crushers.....Bulletin on cylinder and nut type vertical crushers provides drawing, photograph, and detailed specifications showing size, weight, horsepower.
266D Sprout, Waldron & Co., Inc.

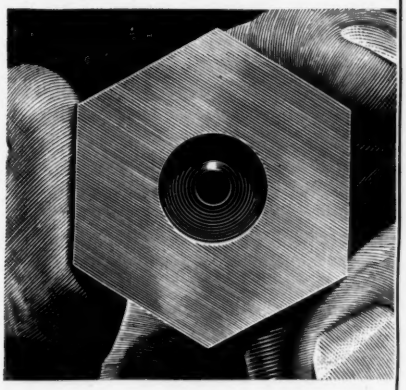
* From advertisement, this issue



This Yarway team has scored high—over a million installed on all types of steam equipment. Stocked and sold by 270 Industrial Distributors. For free Steam Trap Book, write YARNALL-WARING CO., 137 Mermaid Ave., Philadelphia 18, Pa.

go YARWAY with confidence

Here's something you've never seen before!



NEW Carrier

"CANT-CLOG" SPRAY NOZZLE

Cuts maintenance costs on air washers, cooling towers and spray equipment

Proved in more than three years of service as standard equipment on Carrier air washers, this revolutionary new centrifugal type spray nozzle is now available as a replacement on all makes of spray equipment—as caps only or complete nozzles.

It's self-cleaning. It installs in seconds. It's low in cost. And since the orifice is formed in a flexible Buna-N rubber dome, erosion normally caused by restricting particles is eliminated. You get longer nozzle life, less down-time and better equipment performance.

For ratings and complete information on this money-saving new development, write Carrier Corporation, Syracuse, N.Y.

Carrier

LITERATURE . . .

Vibrating Screen.....The Syncro-Matic is available in carbon or stainless steel, with from one to three decks, & a full range of screen meshers & materials. Information.
6-7c *De Laval Separator Co.

Waste Treating.....Booklet outlines equipment for treating industrial wastes, and highlights the engineering services and waste treatment systems offered by company.
267A The Permutit Co.

Pumps, Blowers, Compressors

Air Cleaners.....New Bulletin covers the new line of high-velocity Electro-Cell electronic air cleaners. Efficiency by NBS Dust Spot Test Method is as high as 97%.
267B American Air Filter

Blowers.....Rotary positive blowers capacities range from 50 to 4,000 CFM, pressures to 14 PSIG single, 70 PSIG multi-stage. Full information on request.
249 *M-D Blowers, Inc.

Compressors.....Axial-flow & Centrifugal compressors can be designed to your specifications. Standard models are also available. Bulletin "Joy Turbodynamics."
189 *Joy Mfg. Co.

Gear Pumps & Fluid Motors.....available off-the-shelf for most applications. Full information on pumps, pump & motor combinations, or fluid motors is in Bul. 810-P.
232 *Eastern Industries Inc.

Pumps.....Catalog entitled "Dorr-Oliver Pumps for Hot or Cold Corrosive and Slurry Service" now available on request. Specification and performance data.
267C Dorr-Oliver Inc.

Pumps.....Catalog contains complete information on Gearchem pumps of zirconium & teflon for the process industries. Now available on request.
L240 *ECO Engineering Co.

Pumps.....non-clog pumps for pumping unscreened liquids with large solids in suspension — industrial wastes; sanitary sewage disposal. New bulletin 5440A.
251 *Fairbanks-Morse & Co.

Pumps.....move corrisive liquids, pump 2 or 3 different liquids simultaneously, feed & mix and meter additives. Capacities from 0.5 cc. per min. to 4:5 GPM. Information.
BL208 *Sigmamotor, Inc.

Pumps.....for all corrosive applications. Pumping parts are available in a variety of metal alloys, as well as plastics. Complete information offered.
283 *A. R. Wilfley & Sons, Inc.

Centrifugal Pumps.....Bulletin describes features of a new line of rubber-lined centrifugal pumps. Capacities from 10 to 1,200 gpm. at heads from 15 to 120 ft.
267D Carl Buck & Associates

Pumps, Chemical.....A line of over 78 models, sizes & frame, plus thousands of combinations. An 8-pg. booklet discusses effects of radial loads.
128 *Food Mach. & Chem. Corp.

* From advertisement, this issue

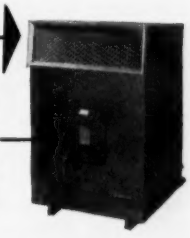
EVEN A HOT **550° F.** *can't faze the finish* when it's

Sicon®

SILICONE HEAT RESISTANT FINISH

ONLY SICON "takes" the 550°F. temperature reached in sections of this Preway heater grille.

ONLY SICON protects this "Direction Flo-Grille" where temperatures often reach above 500°F.



SICON Saves Costly Redesign!
The upper grill of the famous PREWAY heater often reaches a surface temperature of 550°F. Here, the use of an organic finish was found to require raising grille to protect lower part. But in tests SICON protected so well that re-design proved unnecessary! SICON in smart decorative colors can protect your product too—and save money besides! Write for proof.

Brochure shows how SICON achieves more product appeal—withstands 550°F. temperatures without loss of color or gloss. Write for copy today.

Sicon®

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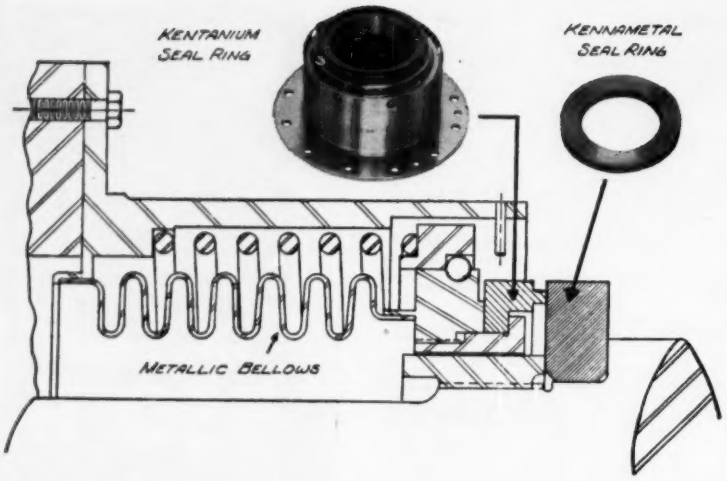
MIDLAND Industrial Finishes Co
Dept E-10, Waukegan, Illinois
ENAMELS · SYNTHETIC · LACQUERS · VARNISHES



KENNAMETAL* Rotary Seal Rings provide substantially zero leakage at mile-a-minute rubbing speeds

At rubbing speeds of 4200 to 5400 ft./min., the hydraulically balanced seal shown above achieves substantially zero gas leakage. Excellent wear characteristics of the Kennametal and Kentanium* Seal Rings featured in this design make possible unlubricated dry rubbing at peak speeds.

Stein Seal Company, Philadelphia, Pa., solved major sealing problems on many applications by using Kennametal and Kentanium parts in their hydraulic balanced seal design such as illustrated above. By using rings made of these hard carbide, wear-resistant compositions, it is possible to operate with higher spring forces and in much higher temperatures than when rings of conventional sealing materials are used.

The outstanding physical properties of Kennametal compositions have provided many more answers to rotary seal ring problems in the fields of petroleum refining and transportation, high-pressure high-temperature chemical production and nuclear power. For example, K501, a platinum-bonded carbide, is being used to confine liquid oxygen and red fuming nitric acid. Results are reported by the customer to be "far superior to any previously-used materials, with no indication of face wear."

Various grades of Kennametal compositions hold economical answers to *your* need for high YME, low thermal expansion, high resistance to abrasion, erosion, corrosion, impact and pressures. For positive sealing, with little or no maintenance, mating surfaces of Kennametal Seal Rings can be lapped to a flatness less than two light bands, with a surface finish better than two microinch.

For more information, just outline your problem and send it to KENNAMETAL INC., Latrobe, Pa.

*Trademark

3130

INDUSTRY AND KENNAMETAL ...Partners in Progress

LITERATURE . . .

Pumps, Chemical.....Type DBR rubber lined pumps are designed to handle hydrochloric & other acids, as well as other corrosive or abrasive liquids. Bulletin 212.
268A Warren Pumps, Inc.

Pumps, Jet Vacuum.....Bulletin 5H-HS describes line of packaged low-level vacuum producers that require minimum floor and space and little head room. No barometric leg.
268B Schutte & Koerting Co.

Pumps, Metering.....Feature new streamlined safety shield, crank-type design, parts interchangeability, etc. Bul. #900, "Look What's New in Metering Pumps."
47 *Hills-McCanna Co.

Pumps, Propeller.....or Axial Flow pumps are widely used to circulate large volumes of liquid or slurry against low heads as in evaporators, crystallizers, etc.
253 *Lawrence Pumps Inc.

Services, Processes, Misc.

Cryogenic Services.....for the design, development, production & testing of a great variety of equipment for cryogenic fluids are covered in the new bulletin now available.
268C Cambridge Corporation

Equipment.....For single-source availability of a tremendous scope of up-to-date equipment, designed for outstanding quality control, information is available.
213 *Allis-Chalmers

Equipment, Safety.....A manual of laboratory safety equipment is available. It contains data for the chemical process industries. Send for your copy.
45d *The Protectoseal Company

Iron Equipment.....Catalog A-9 gives complete information on blinds, spacer rings, temporary & line strainers and pivot flanges. Available on request.
B225 *The Mack Iron Works

Metal Filter Media.....Two brochures outline what filters can do for your filtration problems. Filters handle temperatures from 420 to 1200 degrees.
40 *Purolator Products, Inc.

Methionine Research.....revealed that the most active protein synthesis involving methionine takes place continuously & independently with the cytoplasm & nuclear chromatin.
53-54c *U. S. Industrial Chemicals Co.

Polyethylene Plant.....Low & medium density resins being produced by high pressure process. Produce 75 million pounds per year of Petrothene resins.
53-54a *U. S. Industrial Chemicals Co.

Refractories.....Carbofrax silicon carbide refractory has high thermal conductivity & load - bearing strength at high temperatures. Booklet offered.
124 *Carborundum

Water Treatment.....Three units combine for complete water treatment in modular construction. Available in unit sizes of from 1 M.G.D. to 5 M.G.D. Full details.
252 *Hardinge Co., Inc.

* From advertisement, this issue

FIBER RESIN CHEMIST OR CHEMICAL ENGINEER

Salaried position is now available in our Development Division for a Fiber Resin Chemist or Chemical Engineer. Prefer applicants with an MS or PhD degree and adequate experience in the field of Fiber Resins and Melt Fiber spinning techniques. Work consists of development engineering on present products, as well as making field contacts and maintaining liaison with our Research Division. Reply should give details of education and work experience and should include salary required. Liberal company benefits including fully paid life insurance and hospitalization plans.

P-1503, Chemical Engineering
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McKee has permanent opportunities for Chemical Engineers experienced in process design for Petroleum and Chemical Plants. For employment at our Cleveland offices.

Send detailed resume to
G. VICTOR HOPKINS

ARTHUR G. McKEE & CO.
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SALES ENGINEERS WANTED

For Cleveland, Detroit, Baltimore, San Francisco, St. Louis and El Paso, Texas. Prefer graduate Chemical, Electrical, or Mechanical Engineers with two or three years industrial experience.

Trainees will receive intensive training course with daily classroom instruction at Waterbury factory before assignment to district office. Mail reply to:

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THE BRISTOL COMPANY
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POSITION WANTED

Chemical Engineer; Opportunity in chemical processing industry in development or production. Interested in operational research and statistics without extensive experience in these fields. Age 29, BChE Princeton, Phi Beta Kappa, grad. work. Experience in supervising manufacturing, product and process development, process design. Has had responsibility for costs and quality control for processing and materials handling operations; administration of incentive wage programs. NYC area preferred, but not essential. PW-1442, Chemical Engineering.

SELLING OPPORTUNITY WANTED

Mfg. rep. desires line of material handling equipment. Now selling to paint, food and chemical process industries. Have line of mixing and grinding equipment, also lines of raw materials. Territory Illinois, Indiana, Wisconsin. Sales 1958 in excess of half million dollars. Only exclusive basis considered. RA-1594, Chemical Engineering.

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CE's nation-wide coverage brings you tips and information on current opportunities in job functions throughout the chemical process industries.

ALCO PRODUCTS NEEDS KEY PERSONNEL FOR NUCLEAR POWER ENGINEERING DEPT.

REPORT DIRECTLY TO THE MANAGER

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Supervises section responsible for reactor analysis, reactor experiments, thermal and hydraulics, mechanical core design and mathematics.

Advanced Technical Degree required. Ph.D. desirable. Several years experience in Nuclear Reactor Science and Engineering necessary, plus experience in technical administration.

CHIEF PROJECT ENGINEER

Administers and executes all projects in accordance with approved schedules and prepares and submits proposals.

Establishes and maintains effective controls and schedules on all projects.

Advanced degree desirable. Must have several years of direct line supervisory experience of engineering projects—preferably nuclear.

HEAD PLANT SYSTEMS ENGINEER

Supervises plant design engineering for the application of nuclear energy. Responsible for materials technology, including radio-chemistry and chemical engineering.

Advanced Technical Degree desirable. Several years of plant design experience necessary. Nuclear experience desirable.

Please send complete resume in confidence to: G. Y. Taylor, Administrative Services

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to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

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Highly respected manufacturer of plastics, resins, rubber products & adhesives offers a splendid opportunity for a young man with supervisory potential. Start $12,000 to $14,000. All expenses assumed by client.

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15—ROTARY KILNS, Dryers, Coolers, 11'x155'; 8'x125'; 8'x100'; 8'8"x70'; 8'x50'; 7'x60'; 5'x24'; 4'x25'; 2'x30'.
2—STEAM TUBE DRYERS 6'x50' & 6'x25'.
1—BUFFALO 5'x30' Rotary Vacuum Dryer.
1—50 gal. S.S. Jktd., Agit., Reactor.
1—DRACCO 2600 cfm Dust Collector S.S.
1—GAYCO 14' Air Separator.
3—SWENSON-WALKER 24"x20' double spiral, jacketed Crystallizers, 2 HP.
2—STOKES DDS-2 Tablet Presses.
10—TYLER-HUMMER Screens, 4'x6'; 4'x8'.
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8—EVAPORATORS, 500 to 15,000 sq. ft.
10—AGITATORS 2 HP exp. proof Lightnin' LDG 200 stainless 431 RPM.
1—PFAUDLER 750 gal., glass lined jacketed, agitated Reactor, 15 HP motor.
1—PFAUDLER 200 gal., G.L., jktd. agit.
1—COLUMN nickel clad 6'x27', 200 PSI.
1—REACTOR 750 gal. jkt. 300 PSI.
1—COLUMN 72"x30' Type 347 Stainless Steel, 20 bubblecap trays.

2—20 TON/DAY CHEMICO SULPHURIC ACID CONTACT PLANTS

3—ROTO LOUVRE DRYERS Link Belt steel 502-16, 705-24; stainless 604-24.
4—316 STAINLESS STEEL Condensers 315 sq. ft., 156—1"x8' tubes.
5—CUPRO-NICKEL Heat Exchangers; 177; 346; 1035; 2330; 5200 sq. ft.
25—STEEL Heat Exchangers; 189; 880; 1042; 2060; 3900; 4420 sq. ft.
1—INDUSTRIAL Type SS-2 stainless Pressure Leaf Filter, 195 sq. ft.
1—NIAGARA Stainless Filter, 54 sq. ft.
3—SWEETLAND #10, #12 Pressure Filters, Stainless and steel leaves.
18—SHRIVER, SPERRY 12" to 42" steel, aluminum, wood Filter Presses.
3—RAYMOND 5 Roll low-side Mills.
1—RAYMOND 30" dbl. Whizzer Separator.
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1—ROBINSON Style B Cutter 30" knives.
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1—HARDINGE 8'x30" Conical Ball Mill.
3—TOLHURST 40" S.S. Centrifugals, Susp.
2—FLETCHER 40" Steel Centrifugals, Susp.
1—FLETCHER Whirlwind 48" Centrifugal.
1—FLETCHER 30" stainless Centrifugal, Susp., perforated basket, vaportite.
2—OLIVER 5'3"x3' Precoat Filters 316 stainless steel vaportite.
2—SHARPLES C-20 S.S. Super-D-Hydrators.
2—SHARPLES PN-14 Super-D-Canters S.S.
4—KOMAREK-GREAVES 27"x23" Briquetting Presses, Feeders & 75 HP motors.

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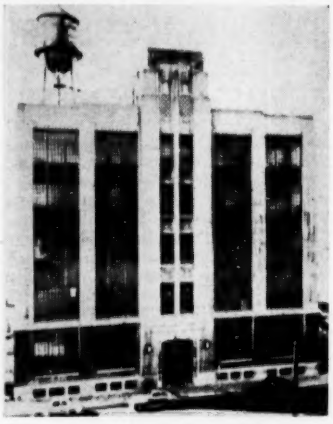

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496 CFM	Vac. 14 x 7 CP-T(3)
502 CFM	125 PSI 12x13 Worth HB, IR-ES
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686 CFM	100 PSI 14x13 Ing. ES PENN-3AT
690 CFM	125 PSI 13⅛/8x7 Chic YCE
1545 CFM	110 PSI 21/13x14 IR XRE
3135 CFM	Vac. 31x13 Ing. ES
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60'-600' portable—gas or diesel

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North Bergen, N. J. UNion 5-4848

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BP 100 gal. 4 side Jktd. Mixer Cored Sigma arms
Patterson-Kelley 40 cu. ft. Blender with Motor
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YOU CAN BANK ON

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S. S. Reactor 1200 gal 200 lb pressure
Baker Perkins 150 gal 40 HP, 100 gal 50 HP both S.S. 2 arm jacketed vacuum hydr. tilt.
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50 gal S.S. Autoclave 2000 lbs pressure
Vulcanizer 60" X 9' 125 lbs.
Sweetland #2 all stainless
Stainless steel Ball Mill
Aluminum Condenser 350 sq. feet
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Proctor & Schwartz finned drum driers
Continuous Stripping column 2 X 13 Steel
S.S. Centrifugals 40" bottom discharge, plow
Calenders 3 Roll 45" X 18": 6 Roll 12" X 5"
Hydraulic Pumps. Motors.

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WIRE US COLLECT!

4—New Stainless Steel Tanks, 2—250 gallon, 2—350 gallon
2—Buflovak Model J Vacuum Shelf Dryers, 20 shlvs 2½" centers
4—Haveg Tanks, 2—7' x 7' 2000 gals, 2—6' x 6' 1250 gallons
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1—Eimco 3' x 6' Rubber Vac. Filter, 316 S.S. Repulper
1—Sperry 30" x 30" Filter Press, 54 frames, 53 plates

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Stainless Hummer Screens

Type CA 40—22¼" x 34"
40 Mesh—New Condition—75 Available

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Woodward 1-8277

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SURPLUS EQUIPMENT
SINGLE ITEMS OR ENTIRE PLANTS

FOR SALE

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1—Tolhorst 40" Centrif (Sus. Style).
1—4'x9' Two Roll Drum Drier
1—4x9 Stokes Dbl. Roll Dries 100 psi Steam
2—5½T Colton Sing Pch Tab. Presses, 40T Cap
1—Rotex Sifter 21"x41"
3—Baker-Perkins 200 wc Mixers, blt 1942
1—Baker Perkins 7 gal wc Mixer

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LIQUIDATION

CENTRIFUGES—FILTERS —EVAPORATORS—CRYSTALLIZERS

1—Bird 32" x 50" solid bowl continuous Centrifuge, 316 S.S.
4—Sharples C20 Super-D-Hydrators, 316 S.S.
2—Sharples PN14 Super-D-Canters, 316 S.S.
1—AT&M 26" suspended Centrifuge, perforated basket, 316 S.S.
2—Oliver 8' x 8' Precoat rubber covered Rotary Vacuum Filters.
4—Sperry 36" rubber covered Plate & Frame Filters, 30 chambers.
2—Sperry 42" Aluminum Recessed Filters, 30 chambers.
4—Shriver 36" wood Plate & Frame Filters, 44 chambers.
5—Struthers-Wells 8' dia. x 24' high rubber lined Vacuum Crystallizers.

PULVERIZERS AND MILLS

2—Abbe 5' x 16' brick lined Mills.
3—30" dia. Stainless Steel Micronizers complete with Hoppers, Conveyors, etc.

KILNS AND DRYERS

1—Traylor 11' x 155' Rotary Kiln, ⅞" shell welded, 2 tires.
1—Vulcan 8' x 125' Rotary Kiln, ¾" shell riveted, 2 tires.
1—Vulcan 8' x 50' Rotary Kiln, ⅝" shell welded, 2 tires.
2—Rennenberg 6' x 60" Rotary Kilns, ⅝" shell riveted.
1—Proctor & Schwartz 8' wide x 60' long Conveyor Dryer, Stainless Steel Belt.

RUBBER LINED TANKS

4—3400 gal. 8' x 8' with Nettco Turbo Agitators, 15 HP motors.
1—4000 gal. 10' x 7'6" with Nettco Turbo Agitator, 10 HP motor.
1—4500 gal. 9' x 9' with Nettco Turbo Agitator, 3 HP motor.
1—5000 gal. 9' x 10' with Nettco Turbo Agitator, 15 HP motor.
5—8500 gal. Vertical Storage, 8'6" x 16' x 8' cone.
1—13,000 gal. Horizontal Storage 8' x 35'.

STEEL TANKS

4—2000 gal. 7' x 7' with Nettco Turbo Agitators, 10 HP motors.
1—3000 gal. 8' x 8' with Patterson Turbo Agitator, 10 HP motor.
1—5200 gal. 10' x 9' with Patterson Turbo Agitator, 10 HP motor.
15—Storage Tanks: 3800; 6000; 9000; 10;000; 15,000; 47,000 gal.

OTHER ITEMS

11—Steel Buildings 20' to 80' trusses.
2—Shepard Niles 20 ton Overhead Cranes.
7—Dorr Thickeners; 16' dia. with Tanks.
1—Bemis 50# Bag Packer with Sewing Machine, Conveyor and Flattener.
125—LaBour, Durco, Worthite, Duriron and Stainless Steel Centrifugal Pumps 2" to 6" with motors.

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6—Struthers Wells 2000 gal. 316 S.S. jktd. agtd. Reactors.
2—Struthers Wells 1000 gal. 316 S.S. jktd. agtd. Reactors.
1—1500 gal. Pfaudler, glass lined, jktd. agtd. Reactor.
1—500 gal. Walters, 304 S.S. jktd. agtd. Reactor.
1—1400 gal. Blaw-Knox, steel, jktd. agtd. Reactor.
1—Baker Perkins 700 gal. jktd. agtd. Dissolver.
1—550 sq. ft. Buflovak, monel, single effect Evaporator.
1—250 sq. ft. Buflovak, 304 S.S. forced circulation Evaporator.
1—20 sq. ft. Buflovak, 304 S.S. forced circulation Evaporator.
1—3500 gal. 304 S.S. jktd. agtd. Tank, 9' x 7'.
1—7500 gal. 316 S.S. Vert. Storage Tank, 7' x 25', 50 PSI.
1—20,000 gal. 374 S.S. Vert. Storage Tank, 12' x 23'.
1—750 gal. nickel clad Mixing Tank, 125# int., with nickel coils.
1—3000 gal. Aluminum Vert. Tank, 6' x 18'.
1—4000 gal. Haveg Vert. Tank, 8' x 12'.
1—12,000 gal. horiz. steel Pressure Tank, 7'6" x 36', 200 PSI
8—Stainless Heat Exchangers; 1220, 942, 786, 536, 396, 315, 250, 157 sq. ft.
1—24" dia. x 35', 304 S.S. Bubble Cap Column.
1—30" dia. x 20', 304 S.S. Bubble Cap Column.

CENTRIFUGES

1—Bird 18" x 28", 316 S.S. Solid Bowl, Continuous.
1—Bird 18" x 28", steel, Solid Bowl, NEW, Continuous.
2—Sharples PY14, PN14, Super-S-Canters, 316 S.S.
1—Sharples H2 Nozzlejector, 15 HP, 304 S.S.
1—Bird 40" suspended, 347 S.S., perforated basket.
1—Tolhurst 30", 304 S.S. underdriven, perforated basket.
2—Sharples #16, 304 S.S., 3 HP motor.

FILTERS

1—Oliver 5'3" x 8' Steel Rotary Vacuum, vaporite housing.
1—Sparkler 33S28 Filter, 150 sq. ft. 304 S.S.
1—Niagara 36H110 horizontal Filter, 110 sq. ft., 304 S.S.
1—Sparkler 33-S-17 Steel Filter, 92 sq. ft.
1—#12 Sweetland Filter, 48 leaves, 3" centers, 640 sq. ft.
2—#10 Sweetland Filters, 27 leaves, 4" centers, 250 sq. ft.
1—Brosites 120 plate 304 S.S. Dialyzer.

DRYERS

1—Devine Vacuum Shelf with 19—59" x 78" shelves.
1—Devine Vacuum Shelf with 10—40" x 43" shelves.
2—Overton 42" x 120" Atmospheric Double Drum.
2—Devine 5' x 12', 4' x 9', Atmospheric, Single Drum.
1—Baker Perkins 5'6" x 6' Rotary Vacuum Dryer.
1—Buflovak 3' x 20' Rotary Vacuum Dryer, 316 S.S., Unused.
2—Louisville Rotary Steam Tube, 6' x 25', 6' x 50'.
1—Rotary Kiln, 9' x 130'.
4—Rotary Dryers, 4' x 40', 6' x 50', 5'6" x 50', 5' x 30'.
2—Link Belt; 7'5" x 25" Monel 6'4" x 24' 316 S.S. Rote Louvre Dryers.
3—Louisville 8' x 50' Stainless Steel lined Rotary Dryers.
2—Vulcan 7' x 80' Rotary Dryers.
1—Traylor 30" x 18' Stainless Steel Rotary Dryer.

MIXERS

1—Baker Perkins #16TRM, 150 gal., jktd., sigma blades, Vac. 50 HP motor.
5—Baker Perkins #15 JIM2, 100 gal. jktd. sigma blades, 20 HP motors. UNUSED.
5—Day "Cincinnatus" double arm, 250 and 100 gal.
3—1500# Powder Mixers, 7½ HP XP motor.
21—Steel, jktd. Powder Mixers: 225 and 350 cu. ft.

MISCELLANEOUS

1—Patterson 5' x 6' Steel jktd. Ball Mill.
1—HPM 88 ton horizontal Steeping Press.
2—Kent, Ross, 6" x 14" Three Roll Mills.
3—Swenson Walker Continuous Crystallizers, 24" x 30' sections.
3—25 ton Freon Refrigeration Units.
4—Rotex Sifters: 40" x 84", 60" x 84".
3—Robinson Gyratory Sifters, 30" x 104", Triple Deck.
8—Stokes DDT, DDS2 T, "R" and "F" Tablet Presses.
10—Nash Vac. Pumps: H6, L5, L3, TS7, #2, MD572.
25—Chlorimet Durimet and Duriron Centrifugal Pumps 1½" to 6".

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4—Komarek-Greaves briquetting presses, 75 HP, 25 tons per hour.
4—Komarek-Greaves vertical Fluxers (paddle mixers), 150 HP.
4—K-G Horiz. Fluxers 41" dia., 50 HP.
4—K-G Pug Mills, 30" dia. x 14'4".
8—Tyler Screens, 4' x 8', 4' x 6'.
2—42" wide travelling-screen cooling conveyors, total of 850'.
4—36" x 24", 24" x 18" Jeffrey hammermills, 50 HP, 25 HP.
6—Robinson Sawtooth Crushers.
2—Pa. Crusher #C-3-30 hammermills.
20—Welded Steel bins, cone bottom, from 15,000 gallon to 90,000 gallon.
4—Keeler Boilers 200 HP, 160 PSI.
8—16" & 24" trough-belt conveyors, 100', 250', 500' long.
6—36' & 48" apron feeders, 8' long.
8—Bucket elevators, 62' and 90' c-c.
6—500 KVA Transformers.

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Steel 3 Roll, 9" x 32", 12" x 30" & 16" x 40".
Lehman 4 Roll W.C. 12" x 36" Steel
Colloid Mills 1½ HP. & up
Mixers: Baker Perkins Jack. 100 gals.
Day Imperial 30, 75 & 150 gals.
Change Can Mixers 8, 15, 40 gals.
Day Jumbo 700 gal. horiz. mixer.
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Dry Powder, various sizes.
Baker-Perkins size 17, 30 hp.
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Mix-Muller Simpson Lab., Porto, #00.
Percolator: Pfaudler 54 x 42" st. st. jack.
Pumps: Rotary, gear, centrif., vacuum.
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MILLS—Colloid—1½" US 7½ HP, 2" B&S 20 HP, PA Robinson 5 HP, Sprout Waldron 2—40 HP motors
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8501 Bird S/S 32" x 50" Solid Bowl Continuous Centrifugal; Type 316.
4987 Bird S/S 24" x 38" Conical Bowl Cont. Centrifugal; 20 HP.
4593 K1 Bird Cont. Centrifugal Model LB-444; 18" x 28"; 200 RPM.
5004 Fletcher 12" Standard 12" Centrifugal No. 8015.
8503 A.T.&M. 26" Suspended Centrifuge in Type 316 S/S.
4926 Squier 30" Suspended S/S Centrifuge; Perg. Basket; Bt. Dump.
4041 P4 DeLaval industrial Centrifuge Model AA-OO in Type 316.
4945 DeLaval industrial Hermetic Separator VO 244-Type 316 S/S.
4818 Sharples PN14 Super D Canter in Stainless with 10 HP Motor.
4366 Podbielniak Counter Current Solvent Extractor; Multi Stage.

REACTORS—VACUUM PANS STILLS—PRESSURE VESSELS

5020-C 950 Gal. Stainless Lined Vacuum Kettle; 60" x 76" with manhole closed top and agitator.
4986 C 12-12 Two Closed Top, Coned Bot. Vessels in Type 316 Stainless 7' x 7'6".
4737 H 15 Vert. Closed Top 800 Gal. Reactor; S.S. 51" x 118"; 24" Manhole.
4429 C 1 Two Stainless 4600 Gal. Closed Dished Top Vessels; 10' x 4'6" with Top entering agitator.
4767 W 1 Harris Stainless Vac. Pan; 6' x 16'6"; with coils, barometric condenser, controls and accessories.
3870 M 2 Mojonnier S/S Vac. Pan 3' x 10' with Calandria etc.
4627 Mojonnier Stainless Vac. Pan 6' x 12" complete with accessories.
3999 VI Lancaster Rotary Jacketed Reactor Stainless Lined; 50" x 17'4" 300 PSI internal 130 PSI Jacket.
4954 T 5 Patterson-Kelley Stainless Extractor or Percolator; 200 gal; 28" x 76"; perf. screen plates.

STAINLESS FILTER PRESSES plate and frame by Sperry or Shriver; 12", 18", 30".

HEAT EXCHANGERS—CONDENSERS

4576-C1 Struthers Wells S/S Heat Exchanger; 774 sq. ft. with (¾") Tubes; 12 Pass.
4576-C2 Same as above 990 sq. ft. with 440 (¾") tubes.
4551-S2 Whitlock Brine Exchanger in Stainless; 18" x 12'4"; having 204 (¾") tubes; 440 sq. ft.
4221 P 1 Whitlock Stainless Heat Exchanger; 2 Pass; 17" x 128"; 250 sq. ft.
4576 C3 Horizontal Stainless Condenser; 872 sq. ft. 24" x 14' having 384 (⅝") Tubes.
4344 H 4 Stainless Tubular Condenser; 26" x 9'4"; 350 sq. ft.
4000 K1 Vertical Stainless Condenser; 16" x 11'10"; 230 (½") S.S. Tubes.
4954 T 3 Patterson-Kelley Stainless Heat Exchanger; 8" x 14'; 38 sq. ft.
4726 M 15 Vertical Single Pass S/S Heat Exchanger; 13½" x 10'4" having 110 (¾" Tubes).
4749 Stainless Sanitary Heat Exchanger; 65 sq. ft. 48 (1") Tubes.

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STAINLESS DRYERS

4042 K 4 Hersey Rotary Gas Fired S/Dryer; 5' x 26' Counter Current.
4690 Rotary Stainless Lined Dryer 50" x 20' screw feed, Oil Burner etc.
4819 M 4 Louisville Stainless Rotary Dryer 30" x 28' indirect.
3364 B 2 Squier Rotary Atm. Dryer Type 357 Stainless; 30" x 20' with Aerofin heaters.
3853 S 7 Raymond Flash Dryer Type 316 Stainless contacts; alternate available in mild steel.
4621 G Three Stainless Dry-Drums 48" x 56".
3303 Drying Roll 32" x 52" in Type 316 Stainless; cored shaft.

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TANKS

12—4500 gal. nickel-clad, vert., 125# WP
4—3500 gal. nickel-clad, vert., VAC.
1—3000 gal. alum., vert., open
1—10,500 gal., T304 SS, horiz., UNUSED, dished heads
2—5700 gal., T304 SS, horiz., UNUSED
4—Vacuum tanks w/coils, T304 SS: 3700, 3000, 2350, 1750 gal.
1—3400 gal., T304 SS, horiz.
1—2000 gal., T316 SS, hopper
8—1750 gal., T304 SS, hoppers
1—1400 gal., T316 SS, ASME 175#

CENTRIFUGALS, BASKET

1—48" A.T.&M. susp., T304 SS perf., vapor-tite.
6—40" A.T.&M. Swsp., T304 SS Solid basket, 40 HP, 1952
1—40" Bird, susp. steel, imperf.
1—40" Fletcher, susp. steel perf.
1—36" Tolhurst, bronze center-slung.
1—30" Fletcher, susp., T304 SS perf.
1—30" Fletcher, underdriven, T304 SS.
1—26" Fletcher, underdriven, T316 SS.
1—26" Tolhurst, susp., steel perf.
1—12" Fletcher, underdriven, T304 SS.

CENTRIFUGALS, CONTINUOUS

4—Sharples Super-D-Hydrators, C-20, C-27, T316 SS, monel.
2—Sharples PN-14 Super-D-Canters.
7—Sharples #16, T304 SS.
2—Sharples #18V, vapor-tite.
1—Bird 18" x 28" horiz., T304 SS.
3—Bird 24" x 24", slotted screen monel.
1—Bird 32" x 50" horiz., T316 SS.
2—DeLaval #BUH-3930, T304 SS.

DRYERS, VACUUM SHELF

1—356 sq. ft. Devine, Steel
2—108 sq. ft. Anderson, T316 SS.
2— 80 sq. ft. Devine, UNUSED.
1— 36 sq. ft. Stokes, Steel.
1— 24 sq. ft. Stokes Steel.
1— 12 sq. ft. Stokes, Steel.

ROTARY KILNS—DRYERS

2—7'6" x 42' Kilns, ½" shell, 10' comb. chamber, UNUSED
1—11' x 155' Traylor, ⅞" shell Kiln
1—9' x 100' Vulcan, ⅝" shell Kiln
1—8' x 170', ¾" shell, 3-tire Kiln
1—8' x 126' Vulcan, ¾" shell Kiln
1—8' x 115', ⅝" shell, 2-tire Kiln
2—8' x 50' Vulcan, ⅝" shell Kilns
2—7'6" x 100', ½" shell Kilns
2—6' x 60' ⅝" shell Kilns
1—4' x 24', 2-tire Kiln
4—Hardinge 8'8" x 70' Dbl. shell dryers, #XA-18, welded, ½" shell.
1—7'6" x 65' dryer, ½" welded shell.
1—Allis-Chalmers 7' x 50' Dbl. shell dryer., ½" shell, 50 HP
1—6' x 50' Louisville dryer.
6—Steel dryers: 5'6" x 50', 4'9" x 32', 4'6" x 40', 4'6" x 32', 4' x 30', 3' x 15'.
2—Stainless dryers: 4'6" x 12', 3'6" x 12'.

TREMENDOUS LIQUIDATION

Type 316 Stainless Steel Equipment

CHEMICAL PLANT—ORANGE, TEXAS

SPECIAL ITEMS

2—Bird-Young 4' dia. x 3' face rotary Vacuum filters, T316 SS, 40 sq. ft.
3—Sharples C-20 Super-D-Hydrators T316 SS.
1—Alco 60 sq. ft. vertical pressure leaf filter, T316 SS.
3—18,000 gal. Aluminum Cone bottom tanks, 12' dia. x 31' O.A.H.
4—1000 gallon Crystallizers, T316 SS, 5' dia. x 7' high, dished top, conical bottom.
7—500 gallon Crystallizers, T316 SS, 3'6" dia. x 7' high, dished top, conical bottom.
3—Worthington 160 Ton steam jet refrigeration units.
1—Pneumatic Conveyor System, approx. 1150' 10" dia. Aluminum Pipe.

TYPE 316 STAINLESS STEEL KETTLES

4—3,500 gal. kettles, 7' dia. x 12' high, T316 SS, 11/32" shell, dished heads, 11 turns SS coil, 10# jacket, Tur-speed agitator, 40/20 HP-1750/500 RPM.
1—2,500 gal., 6' dia. x 12' high, T316 SS, with pipe coil.
3—1,000 gal., 5'6" dia. x 6' high, T316 SS, int. coils, turbine agit.

TYPE 316 STAINLESS STEEL TANKS

1—17,650 gal. 9' dia. x 36' long, T316 SS, ¼" shell, ⅜" heads w/coil.
2—7,500 gal., 10' dia. x 13' high, T316 SS, ½" shell, w/10 HP SE agit.
2—5,000 gal., 11' dia. x 7' high, T316 SS, 7/16" shell, ½" heads.
12—2,300 gal., 7' dia. x 8' high, T316 SS, ¼" shell, coils (some with agitator).
2—2,000 gal., 6'6" O.D. x 8' long, ¼" shell.
5—1,000 gal., 5'6" dia. x 6' high, T316 SS, w/coils (some with turbine agitator).
4—1,000 gal., 5' dia. x 7' high, dished top, 42" deep conical bottom, (crystallizer tanks).
1—850 gal., 4' dia. x 9' high with coil and 1½ HP Lightnin' agitator.
7—500 gal., 3'6" dia. x 7' high, ¼", dished top, 4' deep conical bottom (crystallizer tanks).
55—Tanks and Pots from 10 gal. to 350 gal. sizes, vertical and horizontal, dished heads.

COLUMNS—STAINLESS STEEL

1—108" dia. Vulcan scrubber, 10 trays on 12" centers, 252—bubble caps per tray.
1—96" dia. x 13' high scrubber, 10 stainless steel trays on 12" centers, 276—caps per tray.
2—96" dia. bubble cap columns, 30 trays, 12" spacing, 272—caps per tray, ⅛" shell.
2—60" dia. x 13' high, Vulcan scrubbers, ¼" shell, 10 trays, 100—caps per tray.
2—48" dia. columns, 30 & 25 trays, bubble caps.
3—30" dia. packed columns, 25' high.
4—24" dia. bubble cap columns, 12 trays, T316 SS, 18" spacing.
2—20" dia. stainless steel columns, 25' & 30' high.

COLUMNS—COPPER

1—72" dia. bubble cap copper column, 46'10" high, 40—trays.
2—48" dia. bubble cap copper columns, 25 & 40 trays, 31' & 45' high.
2—42" dia. Vulcan stills, 66" high.
1—24" dia. column, 25'8½" long, 20-trays.

CONDENSERS—HEAT EXCHANGERS—CALANDRIAS—COOLERS

1—1,450 sq. ft. condenser, stainless steel tubes, tube sheets, heads, and baffles.
1—1,200 sq. ft. condenser, stainless steel tubes, steel shell.
14—750 & 800 sq. ft. stainless steel condensers, vertical, T316 SS tubes and heads,
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11—Exchangers 64, 70, 75, 80, 100 sq. ft., T316 SS.
12—Exchangers 20, 30, 47, 50, 52, 54 sq. ft., T316 SS.

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40—Stainless steel pumps, 1" to 6", 1 HP to 20 HP.
3—Steel columns: 48", 30", 20" dia.
2—St. St. bucket elevators, 62' and 45' high.
300—Valves, T316 SS, up to 10".
4—Stainless steel screw conveyors and chutes.
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18—Separators, T316 SS, 22" x 8' overall depth, cone type.
1—Croll-Reynolds #21 jet vacuum air pump, capacity 50# per hour.
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1—Blaw-Knox 400 gal. steel jacketed autoclave, 570# internal pressure, 85# jacket
1—Columbia Engineering high pressure storage tank, 2400 gal. 265# working pressure
1—Dover Tank Co. horizontal 4000 gal. nickel tank, 30 psi
2—Pfaudler type 316 SS, 700 gal. jacketed kettles with condensers, columns and receivers

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5—Link Belt steel roto louver dryers, Model 207-10, 310-16, 310-20, 604-20, 1003-30
1—Buflovak double drum dryer 42" x 120"
1—Stokes Model 59DS steel rotary vacuum dryer, 5' x 30'
1—Stokes double drum dryer, 5' x 12'
1—Louisville rotary steam tube dryer, 8' x 45'
1—Louisville SS rotary kiln, 30" x 28', complete
1—Stokes SS rotary vacuum dryer, 2' x 6'
6—Stokes steel jacketed rotary vacuum dryers, 3' x 15'
1—Louisville SS rotary dryer, 8' x 50'
1—Louisville rotary dryer, 38" x 40', Type L

FILTERS

1—Oliver horizontal filter, 6'6"
1—Sweetland #3 SS filter
1—Niagara SS filter, Model 510-28
1—Oliver horizontal filter, 3'
1—Feinc SS rotary vacuum string filter, 3' x 3' (NEW)
10—Shriver plate and frame filter presses, 12" to 42"
12—Sweetland #12 filters with 72 SS leaves
1—Shriver rubber lined filter press, 36" x 36"
3—Dorrco 6' x 2' rubber covered filters

MIXERS

10—Day Poney Mixers, 8 and 16 gal.
1—Patterson jacketed vacuum SS kneader master mixer, sigma blade, 300 gal. working capacity
3—Robinson type 316 SS sigma type jacketed heavy duty mixers, 300 gal., 60 H.P.
5—Baker Perkins double arm sigma blade mixers, 100 gal.
1—Patterson monel double cone blender, 4 cu.ft.
19—Robinson SS horizontal blenders, 255 cu. ft.
1—12" x 4', type 316 SS, Pug Mixer

THE GELB GIRL—MAY 1959

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2—Heat Transfer Products steel bubble cap columns, 38" and 42" with 5 and 10 trays
1—Acme steel bubble cap column, 42" dia. with 10 trays
2—Patterson-Kelley steel heat exchangers, 1000 sq.ft. each
6—Struthers Wells heat exchangers, 885 sq.ft.
1—Patterson-Kelley steel heat exchanger, 427 sq.ft.
50—Steel heat exchangers from 15 sq.ft. to 400 sq.ft.
1—Struthers Wells type 316 SS heat exchangers, 330 sq. ft. 170 sq. ft. (NEW)
10—Davis Engineering type 316 SS heat exchangers, 85 sq. ft. to
1—Badger type 316 SS bubble cap column, 42" dia. with 11 trays
1—Badger type 316 SS bubble cap column, 36" dia. with 8 trays
1—Vulcan SS bubble cap column, 4' x 28 plates
3—Robins shaker screens, S. S., 3' x 6'
1—Stokes Model DDS2 rotary tablet press
1—Struthers Wells SS calandria type evaporator, 365 sq. ft.
1—Swenson type 316 SS vacuum crystallizer, 3'6" x 12'
1—Swenson type 316 SS Vacuum crystallizer, 2'6" x 12'
1—Swenson single effect evaporator, SS 320 sq. ft.
1—Blaw-Knox steel distillation column, 36" x 40' with 24 trays, complete (NEW)
3—Williams type 316 SS, hammermills, Model AK
1—Mikro Model 4TH pulverizer
7—Milton Roy Proportioning Pumps, S. S., 1½ GPH to 156 GPH.

1—Ames 300 HP steam generator, 150#
1—Cleaver-Brooks 500 HP package steam generator, 200#
10—Alco type 316 SS, jacketed 3000 gal. reactors, complete with Turbine Agitators and drives, 50 psi.
2—Struthers Wells type 316 SS, jacketed reactors, 3500 gal., complete with coils, agitators and drives.
1—Reitz Thermascrew SS, Model TJMK2-12x8.

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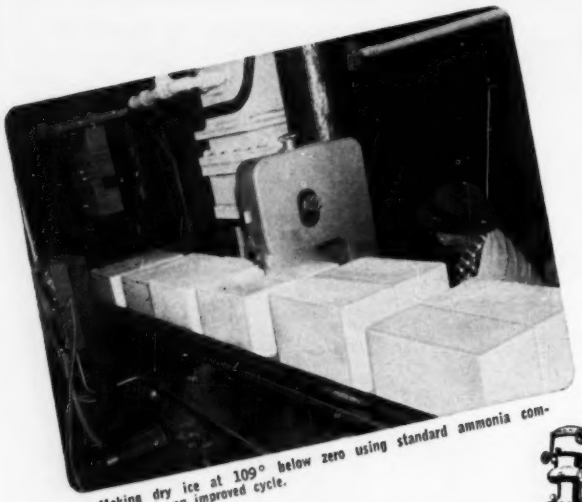

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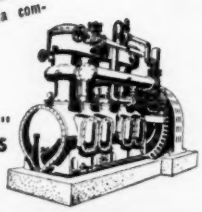

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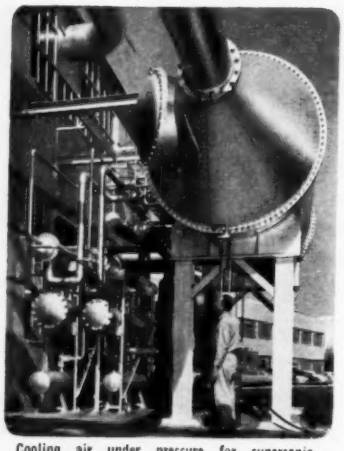

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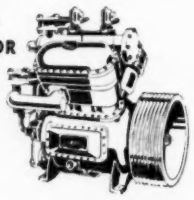

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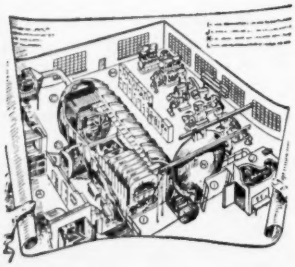

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Adams & Co., R. P. 233
Aerofin Corp. 248
Air Preheater Corp. 46
Alemite, Div. of Stewart-Warner Corp. 127
Allen-Bradley Co. 137
Allied Chemical Corp. (Baker & Adamson) General Chemical Div. 69
Nitrogen Division 185
Allis-Chalmers Mfg. Co. General Machinery Div. 213, 215, 217, 219
Allis-Chalmers Mfg. Co. Hydraulic Division 149
Alloy Steel Products Co. 51
Aluminum Co. of America Electrical Division 112
Amercoat Corp. 199
American Brass Co. Metal Hose Div. 229
American Car & Foundry, Div. of ACF Industries 77
American Cyanamid Co. 20-21
American Machine and Metals, Inc. 114
American Standard Industrial Division 58
Annin Company 131
Armco Steel Corp. 116

Babcock & Wilcox Co. Tubular Products Div., Fittings Dept. 119

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Baldwin-Lima-Hamilton Corp. Eddystone Division 281
Barneby-Cheney Co. 277
BIF Industries, Inc..... 204
Bird Machine Co..... 2
Blaw-Knox Co. Equipment Division 118
Buffalo Meter Co..... 226
Byers Co., A. M..... 109

Carborundum Co. 124
Cambridge Co., Div. of Carrier Corp. 243
Carrier Corp. 267
Ceilcote Co. 230
Chem Flow Corp..... 228
Chemical Construction Corp.... 35
Chemical Engineering 105
Chiksan Co. 16-17
Cole Mfg. Co., R. D..... 233
Colorado Fuel & Iron Corp..... 132
Consolidated Electrodynamics .. 262
Continental Gin Co..... 244
Cooper-Bessemer Corp. 22-23
Crane Co. 95
Crane Packing Co..... 207
Crosby Valve & Gage Co..... 238
Crouse-Hinds Co. 64

Day & Co., J. H..... 218
Dean Products, Inc. Dean Thermo-Panel Coil Div. 208
Delhi-Taylor Oil Corp..... 282
De Laval Separator Co..... 6-7
De Laval Steam Turbine Co...90-91
Dempster Bros. 43
Dings Magnetic Separator Co... 263
Dow Corning Corp..... 212
Downington Iron Works Co..... 13
Dracco, Div. of The Fuller Co..... 117
Ducon Company, Inc., The..... 106
Duriron Company, Inc., The.... 195

Eagle-Picher Co. 60
Eastern Industries, Inc..... 232
Eaton-Dikeman Co. 263
Eclipse Fuel Engrg. Corp. Combustion Division 237
Eco Engineering Co..... 240
Eddystone Division Baldwin-Lima-Hamilton Corp. 281
Electric Controller & Mfg. Co. Div. of Square D Co..... 187
Elliott Company 256
Enjay Company, The..... 183
Esso Standard Oil Co..... 49

Fairbanks, Morse & Co..... 251
Falk Corporation 42
Federated Metals Div., American Smelting & Refining 239
Filtration Engineers 114
Fischer & Porter Co..... 104
Flexonics Corp. 75
Fluidizer Co., Div. of Superior Separator Co..... 108
Forge & Fittings Division H. K. Porter Company, Inc... 280
Frick Co. 276

Garlock Packing Co..... 107
General American Transportation Corp., Turbo Mixer Div..... 135
General Electric Co. Computer Division 181
Glas-Col Apparatus Co..... 89
Goslin-Birmingham Mfg. Co... 234
GPE Controls, Inc..... 41
Graver Tank & Mfg. Co..... 59
Grinnell Company, Inc..... 48
Gustin-Bacon Mfg. Co.....208, 209

Hammond Iron Works..... 257
Hardinge Co. 252
Harshaw Chemical Co..... 8
Hilliard Corp. 236
Hills McCanna Co..... 47

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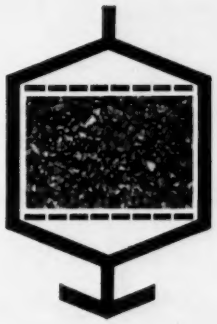

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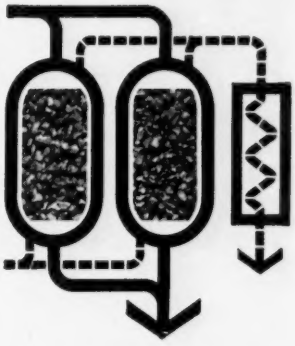

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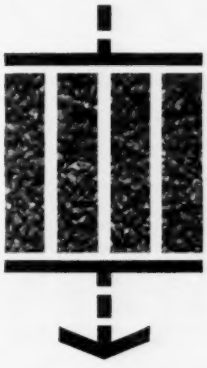

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Hunt Machine Co., Rodney..... 62

Illinois Water Treatment Co.... 235
Ingersoll-Rand 28-29
Instruments, Inc. 259
International Nickel Co..... 57
I-T-E Circuit Breaker Co..... 52

Jamesbury Corp. 206
Jerguson Gage & Valve Co..... 205
Jessop Steel Co..... 71
Johns-Manville Corp. (High Temperature) 36-37
Joy Manufacturing Co..... 189

Kaiser Aluminum & Chemical Sales Corp. 220
Kemp Mfg. Co., C. M..... 201
Kennedy Van Saun Mfg. & Engrg. Co. 141
Kennametal, Inc. 268
Kinney Engineers, Inc., S. P... 225

Ladish Co., Tri-Clover Div. 111
Lawrence Pumps, Inc..... 253
Linde Co., Div. of Union Carbide Corp.....99, 193
Ludlow Saylor Wire Cloth Co... 242

Metals & Controls Corp. General Plate Div..... 4
Mack Iron Works Co..... 225
Mallory-Sharon Metals Corp.... 120
Manning, Maxwell & Moore, Inc. 34, 122
Manton Gaulin Mfg. Co..... 278
Marathon Electric Mfg. Corp... 227
Marsh Instrument Co..... 257
McGraw-Hill Book Co..... 261
M-D Blowers, Inc..... 249
Micro Switch, Div. of Honeywell 50
Midland Industrial Finishes Co. 267
Midwest Piping Co..... 123
Mine & Smelter Supply Co..... 264
Minneapolis-Honeywell 139-140
Mixing Equipment Co.....4th Cover
Morton Salt Co..... 103
Multi-Metal Wire Cloth Co..... 257

National Carbon Co., Div. of Union Carbide Corp..... 44
National Engineering Co..... 211
New England Tank & Tower Co. 87
Niagara Blower Co..... 259
Norton Co., Refractories.....38-39

Pangborn Corp. 210
Partlow Corp. 56
Patterson-Kelley Co. 66-67
Peerless Pump Div., Food Machinery & Chemical Corp... 128
Penfield Mfg. Company..... 260
Permutit Co., Div. of Pfaudler-Permutit 146
Phelps Dodge Copper Products Corp. 18-19
Pitt-Consol Chemical Co..... 214
Pittsburgh Corning Corp..... 279
Pittsburgh Lectrodryer Div., McGraw-Edison Co. 254
Proctor & Schwartz, Inc..... 79
Protectoseal Co. 45
Purolator Products, Inc..... 40

Quaker Oats Co., Chemical Div. 83

Raybestos-Manhattan, Inc. Manhattan Rubber Div..... 134
Read Standard, Div. of Capitol Products Corp..... 121
Richardson Scale Co..... 265
Robertshaw-Fulton Controls Co. Aeronautical & Instruments Div. 191
Fulton Sylphon Div..... 216
Rochester Mfg. Co..... 130
Rockwell Mfg. Co. Nordstrom Valves 125
Rockwood Sprinkler Co. (Ball Valves) 55
Royal McBee Corp..... 148
Ruberoid Co. 265

Safety Industries, Inc. Entoleter Division 235
Saran Lined Pipe Co..... 129
Sargent's Sons Corp., C. G..... 261

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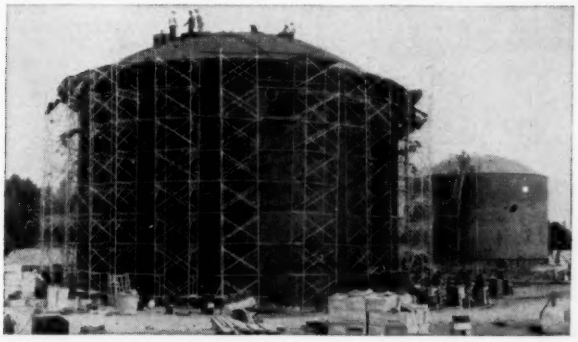

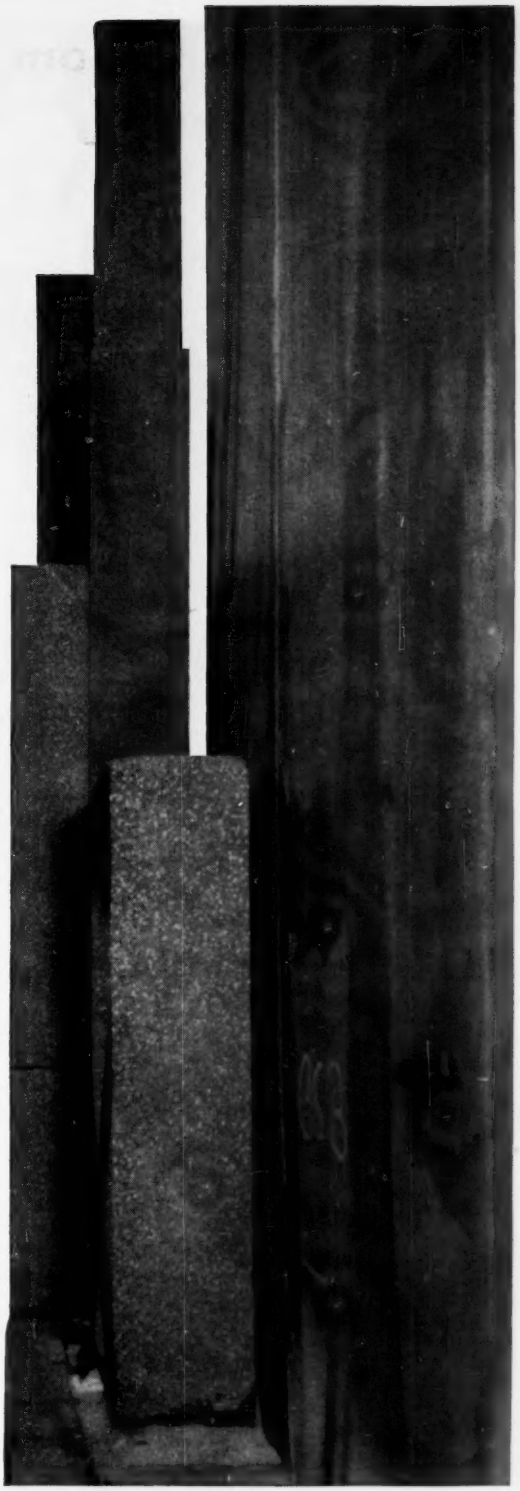

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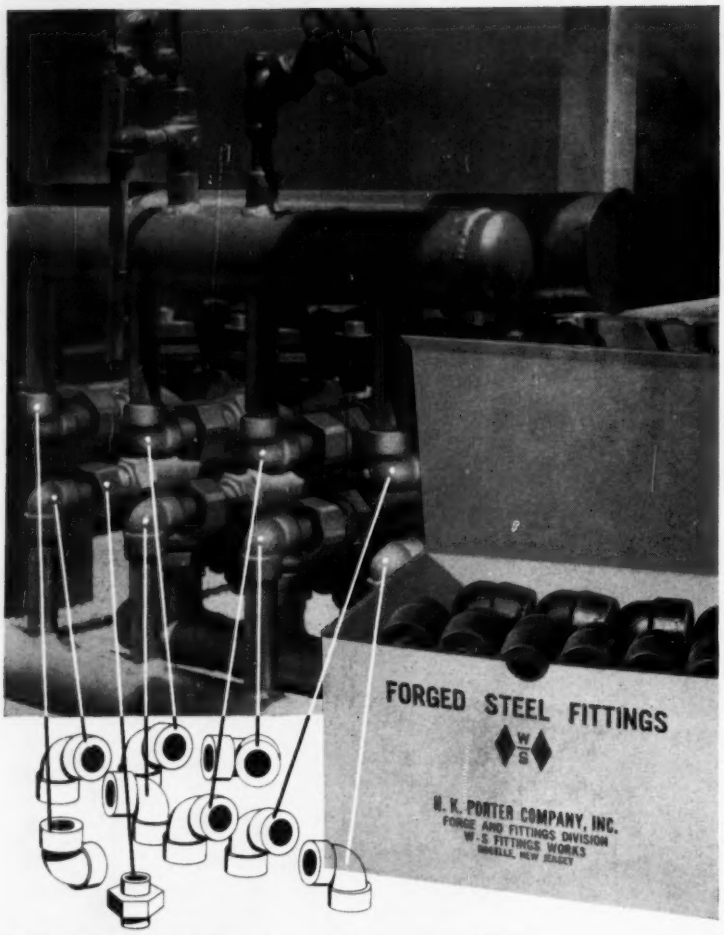

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Schutte & Koerting Co..... 133
Scoville Mfg. Company..... 33
Shell Chemical Corp.....2nd Cover
Shriver & Co., T..... 258
Sigmamotor, Inc. 208
Solar Aircraft Co..... 231
Sonic Engrg. Corp..... 259
Sparkler Mfg. Co..... 32
Speedline Stainless Steel Fittings Div., Horace T. Potts Company 97
Sperry & Co., D. R..... 255
Spraying Systems Co..... 235
Sprout, Waldron & Co..... 126
Stokes Corp., F. J..... 110
Strong, Carlisle & Hammond.... 221
Struthers Wells Corp..... 115
Sturtevant Mill Co..... 266
Strahman Valves, Inc..... 203

Taylor & Co., W. A..... 240
Taylor Instrument Companies..24-25
Terry Steam Turbine Co..... 202
Thermal American Fused Quartz Co. 260
Thermo Electric Co..... 263
Toledo Scale, Div. of Toledo Scale Corp. 205
Tri-Homo Corp. 233

Union Steel Corp..... 93
United Engineers & Constructors Corp. 81
U. S. Electrical Motors, Inc.... 61
U. S. Industrial Chemicals Co. Div. of National Distillers & Chemicals Corp. 53-54
U. S. Rubber Co..... 197
U. S. Steel Co.
American Bridge Div.....30-31
Stainless Steel Div..... 85

Vilter Manufacturing Co..... 250
Vogt Machine Co., Henry..... 150

Walworth Co. 138
Wedgeplug Valve Co., Div. of Stockham Valves & Fittings... 113
Westinghouse Electric Corp.9-12, 223
Western Precipitation Corp..... 147
Wiegand Co., Edwin L.....224, 225
Wilfley & Sons, A. R.....3rd Cover
Wilson, Inc., Thomas C..... 101
Worcester Valve Co.....14-15
Wyandotte Chemicals Co. Michigan Alkali Div.....26-27

Yarnall-Waring Co. 266
York Co., Otto H..... 1

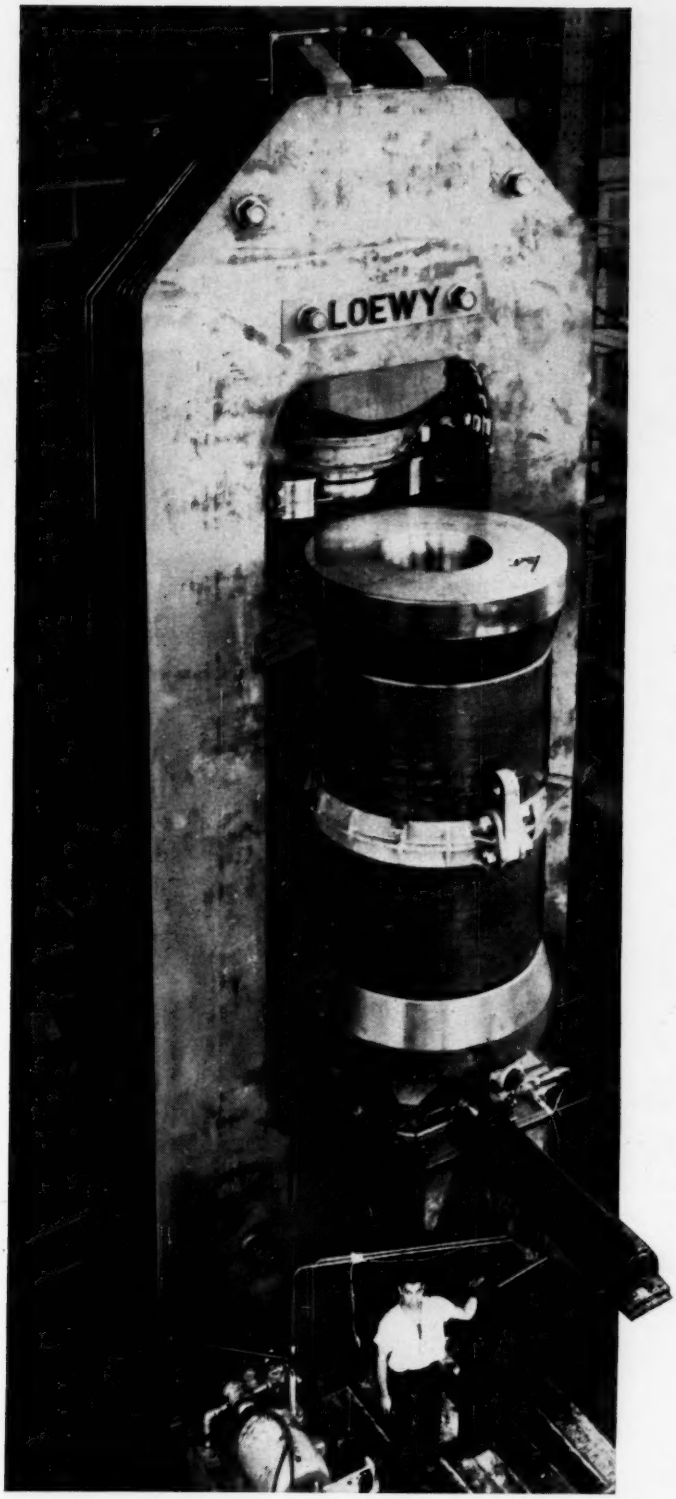
Professional Services 272
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 269

EQUIPMENT (Used or Surplus New) For Sale 270-275

ADVERTISERS INDEX

Aaron Equipment Company..... 270
Alco Products Inc..... 269
American Air Compressor Corp... 270
Bioferm Corp. 272
Bristol Company, The..... 269
Brill Equipment Company..... 271
Curta Company, The..... 273
Equipment Clearing House Inc.... 270
First Machinery Corp..... 273
Gelb & Sons, R..... 275
Globe Trading Company..270-272-273
Heat & Power Company, Inc..270-272
Lawler Company 273
Loeb Equipment Supply Co..... 273
Machinery & Equipment Co. 270-272-273
McKee & Company, Arthur G.... 269
Monarch Personnel 269
Perry Equipment Corporation..272-274
Slavík E. O. 270
Sonken-Galamba Corp. 272
Stein Equipment Company..... 272
Sussman Inc. Louis..... 270
Union Standard Equipment Co.... 272



B-L-H fabricates 30,000 psi vessel

This pressure vessel—believed to be the largest ever built—is one more indication of B-L-H's ability to handle huge and unwieldy jobs efficiently.

The assembled vessel, consisting of a high-pressure container moving in and out of a rigid frame made of six laminated steel plates each 4 in. thick, weighs 474,000 lb. and stands 35 ft. 1¼ in. high.

Designed by B-L-H's Loewy-Hydropress Division for the United States government, this unusual piece of equipment was built to withstand the tremendous operational pressure of 30,000 psi and a test pressure of 45,000 psi. The super-strength bronze sealing retaining rings so essential to successful performance under these extreme pressures were manufactured and machined in the Eddystone Division foundry.

Testing of this vessel, also done at Eddystone, required an elaborate procedure comparable in precision to the observation of a patient's heart during a surgical operation. More than 80 SR-4® strain gages, products of B-L-H's E&I Division, were located at all critical points of the structure. Over 1500 readings were taken of the strains and stresses developed during loading the vessel up to 45,000 psi and down again. Evaluation of all test results and a full year of normal operation proved that the numerous parts and materials behaved even better than anticipated.

Our illustrated Weldment Bulletin 7001 will give you an excellent idea of our vast fabricating facilities. A copy is yours for the asking.

View of high-pressure vessel fabricated at Eddystone showing pressure cylinder withdrawn for loading

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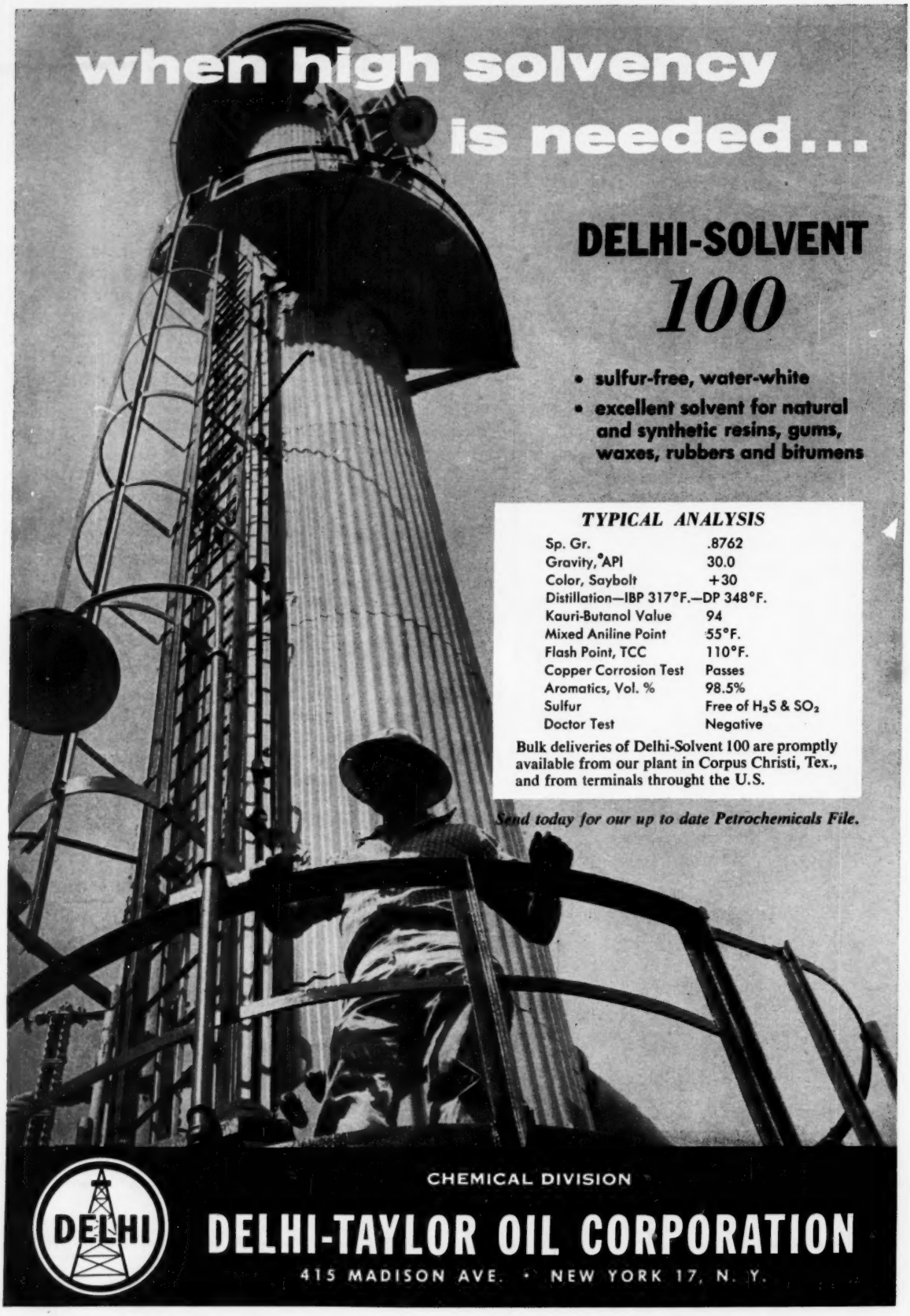
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IF IT'S A CORROSIVE WILFLEY PUMPS IT!

Versatility in the handling of corrosives is only part of the Wilfley story. Add to this — low maintenance costs, continuous, trouble-free operation, higher output, and longer pump life. Important, too, is the fact that every Wilfley installation is job-engineered to give you maximum efficiency and economy.

Pumping parts are available in a variety of metal alloys, as well as plastics, to cover a wide range of corrosive applications.

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Will you reap the long-term payoff of good mixer shaft sealing?

If you want to minimize your mechanical fluid mixing costs, take a hard look at *mixer shaft sealing.*

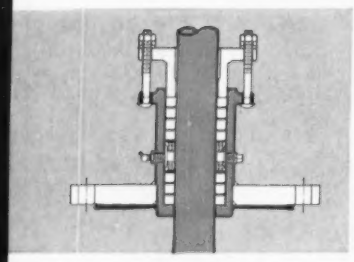
This is the area where profits can leak away unnoticed. The right shaft seal makes all the difference between an efficient mixing operation and a ruinously expensive one.

When you're aiming for low-cost shaft sealing, *don't be fooled* by low first cost. Instead, look for solid long-range savings you can make in terms of *smooth operation, rapid maintenance, minimum downtime.*

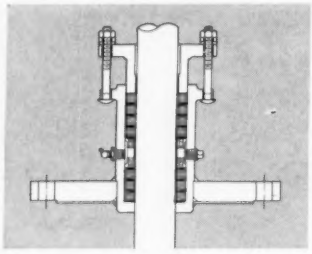
Here are some mechanical reasons why you get these savings with LIGHTNIN Mixers. Every one of the features illustrated below is a LIGHTNIN "first." Many are yours only with LIGHTNINS. And only LIGHTNINS give you *all* of them!

For lowest-cost fluid mixing, see your LIGHTNIN Mixer representative soon. Look him up in Chemical Engineering Catalog. Or write us direct.

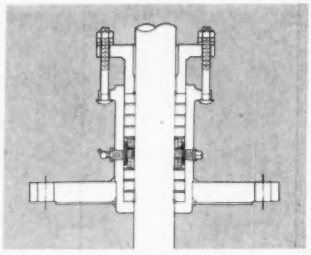
How you cut mixing cost with the *Lightnin* stuffing box



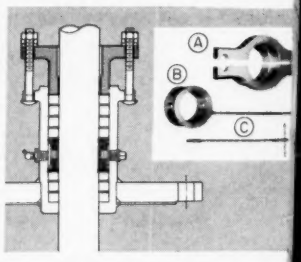
1. SAVE COST of a special-alloy mounting flange with all-welded LIGHTNIN construction. Forged steel flange is faced with correct alloy for your process conditions. Hub is solid alloy. Alloy parts are shown in color.



2. GET SUPERIOR SEALING with 7 rings of large-cross-section packing. Separators facilitate packing removal, distribute force uniformly. Gland bolts, threaded part way, prevent overtightening.

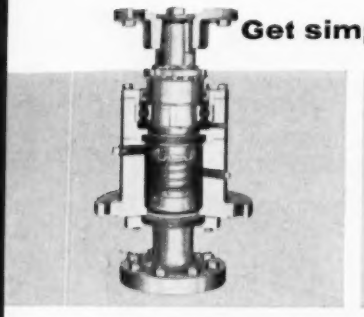


3. GET BETTER LUBRICATION without repacking. Lantern ring evenly distributes lubricant; permits continuous lubrication under pressure; extends time between repackings. Relief plug prevents overlubrication.



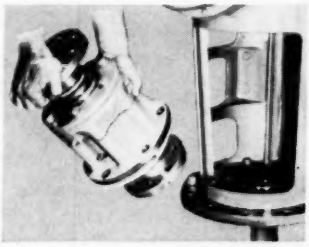
4. REPACK FASTER with exclusive split packing gland (A) that comes right off the shaft to allow maximum work space. Lantern ring (B) lifts out quickly by means of pullers (C), standard accessories.

Get simplest possible maintenance with *Lightnin* mechanical seal*

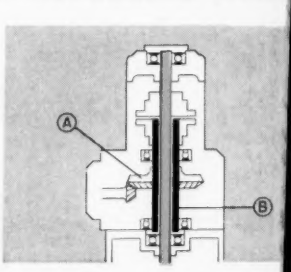


1. ELIMINATE REPACKING and adjustment with this cartridge-type LIGHTNIN rotary mechanical seal assembly, optional on all LIGHTNIN Mixers. It's saving many users thousands of maintenance dollars a year.

2. GET WIDEST CHOICE of seal designs and materials to meet your conditions: stainless steels, Stellite, Hastelloy alloys, bronze, ceramic, Teflon, etc. Handle pressures to 2500 psig and all temperature ranges.



3. REPLACE SEAL ASSEMBLY quickly, if ever necessary—without dismantling mixer or removing it from tank, and *without skilled manpower.* Seal cartridge unbolts, comes out as a unit; replacement bolts in.



4. RETAIN GEAR ALIGNMENT when changing seal. Mixer gears (A) are isolated from shaft by hollow drive quill† (B) —*cannot get out of line* when seal is removed. Shaft realignment is automatic on reassembly.

†patented

WHAT MIXING OPERATIONS are important to you? You'll find a wealth of information on fluid mixing in these helpful bulletins describing LIGHTNIN Mixers:

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- ☐ Top entering; propeller types: ¼ to 3 HP (B-103)
- ☐ Portable: ⅛ to 3 HP (B-108)
- ☐ Side entering: 1 to 25 HP (B-104)
- ☐ Laboratory and small-batch production types (B-112)
- ☐ Condensed catalog showing all types (B-109)
- ☐ Quick-change rotary mechanical seals for pressure and vacuum mixing (B-111)
- ☐ Confidential data sheet for figuring your mixer requirements (B-107)

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